ARI Working Papers

Fort Leavenworth Field Unit

1985-1992

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July 2001

United States Army Research Institute for the Behavioral and Social Sciences

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) July 2001	2. REPORT TYPE Final	3. DATES COVERED (from. . . to) 1985-1992
4. TITLE AND SUBTITLE ARI Working Papers: Fort Leavenworth Field Unit, 1985-1992		5a. CONTRACT OR GRANT NUMBER
		5b. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) Carter, C.F., Flanagan, J.P., Michel, R.R., Ross, C.G., Fallesen, J.J., Patton, M.S., Crumley, L.M., Tiede, R.V., Barber, H.F., McKeown, P.E., Packard, B.J., Halpin, S.M., Lowden, E., Garlinger, D., Cary, J., and Solick, R.		5c. PROJECT NUMBER
		5d. TASK NUMBER
		5e. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: TAPC-ARI-PO 5001 Eisenhower Avenue Alexandria, VA 22333-5600		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue Alexandria, VA 22333-5600		10. MONITOR ACRONYM ARI
		11. MONITOR REPORT NUMBER WP Leavenworth

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

ARI working papers were originally unofficial documents intended for limited distribution to obtain comments. These working papers are being archived in order to preserve material that was not included in other ARI publications. The material contained herein may not meet ARI's usual scientific or professional standards for publication.

14. ABSTRACT *(Maximum 200 words)*:

Thirteen working papers dealing with tactical training, division staff training, command groups, tactical command and control, ACCES, the future battle laboratory, Joint Task Force Six, unit task organization, workplace design, reserve component training, and command posts.

15. SUBJECT TERMS

Tactical training, division staff training, command groups, tactical command and control, ACCES, the future battle laboratory, Joint Task Force Six, unit task organization, workplace design, reserve component training, command posts,

RCIIMS, SICPS, EDDIC.

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT Unclassified	17. ABSTRACT Unclassified	18. THIS PAGE Unclassified	Unlimited	806	David W. Witter (703) 617-0324

Fort Leavenworth Field Unit Working Papers

Carter, C.F., Flanagan, J.P., & Michel, R.R. (1989). Analyzing tactical courses of action workbook. WP LVN 89-02.

Carter, C.F., Ross, C.G., Michel, R.R., & Fallesen, J.J. (1988). Battle scenarios to exercise division staffs: Example staff Products. WP LVN 88-02.

Carter, C.F. Jr., & Patton, M.S. (1985). Command group behaviors: Their identification, quantification, and impact on collective output in automated and nonautomated environments. WP LVN 85-03.

Crumley, L.M., Tiede, R.V. (SAIC), Barber, H.F., & McKeown, P.E. (SAIC). (1985). Design of a modular laboratory for research on tactical C2 (abridged version). WP LVN 85-02.

Evidence Based Research, Inc. (1992). Army Command and Control Evaluation System (ACCES): Application manager's guide. WP LVN 92-02.

Fallesen, J.J. (1991). Assessment of future battle laboratory's corps command post technology insertion. WP LVN 91-02.

Fallesen, J.J. (1991). A concept for measurement of Joint Task Force Six responsiveness. WP LVN 91-01.

Fallesen, J.J., Flanagan, J.P., & Packard, B.J. (1989). Comparison of direct manipulation and form-fill concepts for unit task organization. WP LVN 89-01.

Halpin, S.M. (1992). Army Command and Control Evaluation System (ACCES): A brief description. WP LVN 92-01.

Lowden, E., Garlinger, D., & Cary, J. (1988). Reserve Component Instructional Information Management System (RCIIMS) Test and Evaluation Plan. WP LVN 88-05.

Michel, R.R. (1988). Manpower, personnel and training analysis for the Standardized Integrated Command Post System (SICPS). WP LVN 88-01.

Michel, R.R., & Fallesen, J.J. (1990). Workspace assessment of a battalion task force command post. WP LVN 90-02.

Packard, B.J., McKeown, P.E., Fallesen, J.J., & Solick, R. (1987). Design document: Preliminary requirements for EDDIC. WP LVN 87-01.

WORKING PAPER

WP LVN-89-02

ANALYZING TACTICAL COURSES OF ACTION WORKBOOK

Charles F. Carter, Jr. and James P. Flanagan
Science Applications International Corporation

Rex R. Michel
Army Research Institute

September 1989

Reviewed by: JON J. FALLESEN
Leader, Staff Operations Team

Approved by: STANLEY M. HALPIN
Chief, Fort Leavenworth Field Unit

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

ANALYZING TACTICAL COURSES OF ACTION WORKBOOK

The task of analyzing tactical courses of action is described in detail in FM 101-5, Staff Organization and Operations, and CGSC Student Text ST 100-9, The Command Estimate. The process described there has been divided into steps which are summarized in this workbook. Instructions provided are directed towards a division level U.S. offensive operation. The technique described may be used at any organizational level and supports not only offensive operations but also defensive operations, movement to contact, and retrograde operations.

The analysis and selection of a tactical course of action is described in detail in FM 101-5, Staff Organization and Operations, and Student Text 100-9, The Command Estimate. Each of these manuals discusses in detail the military approach to decision-making and the requisite steps necessary for orderly analysis. The purpose of this workbook is to review this process and provide an easy-to-use guide to assist staff officers in preparing their estimate.

As mentioned in ST 100-9, the estimate process is a complicated and detailed task, and the time stress of modern battlefields will make its application even more difficult; however, the systematic analysis of battlefield events by competent and conscientious officers should produce superior results for complex problems.

Decision-making in the AirLand Battlefield is heavily influenced by both a lack of desired planning time and an influx of possibilities that must be considered. Planning in a vacuum is a luxury that cannot be afforded; rather, it is a continuous, dynamic process that is illustrated in Figure 1 below.

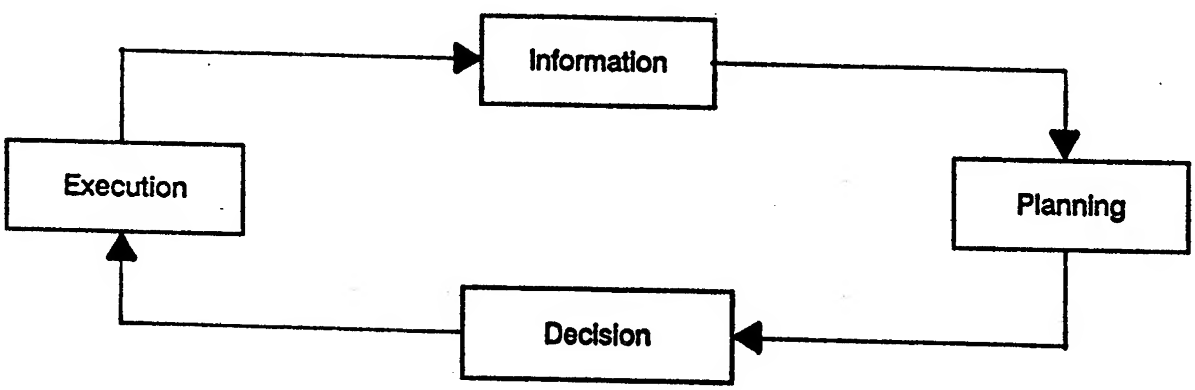

Figure 1. Decision-Making Cycle

All military members involved in the decision-making process must use a logical and fast means of evaluating the battlefield and reaching decisions. To this end, the key to the decision-making process is the estimate of the situation. This process determines the most suitable course of action to accomplish the mission.

Following is an outline of the estimate process. This information is provided as a general review of the subject area and as a guide to assist in evaluation and selection of courses of action. The material has been divided into 8 steps in order to provide a systematic and orderly process that parallels ST 100-9. The remainder of this workbook provides a step-by-step procedure for following the 8-step process.

Step	Worksheet	Resource
Previous task: Develop courses of action for analysis		Div Cmdr's guidance
1. Review area of interest and gather facts (METT-T)	List of Pertinent Facts	Map and overlays Situational Data: Friendly forces Enemy forces Analysis of area of operations Reference Documents (FMs, STs, etc.)
2. List assumptions	List of Assumptions	
3. Array forces for each COA	Map and Tactical Overlays Task Organization Worksheets	Map and overlays Situational Data
4. Determine critical events	Map and Tactical Overlays Critical Event Assignment Worksheets	Map and overlays Candidate Critical Event types (in this workbook)
5. War-game critical events for each COA	Critical Event War-gaming Worksheets	List of Pertinent Facts List of Assumptions Task Organization Worksheets Maps and Tactical Overlays Array of Forces Overlays Lists of Critical Events (graphic and narrative)
6. Aggregate and scale battle results for each COA	War-Gaming Summary Worksheet	Scaling Factors Table (objective measures)
7. Compare courses of action	Course of Action Comparison Worksheet	Subjective Measures Table Scaling Factors Table (subjective measures)
8. Justify recommended COA	COA Selection and Justification Worksheet	
Next task: Develop operation order or plan.		5 paragraph format

Previous Step

Develop Courses of Action for Analysis

DESCRIPTION

The first step in analyzing tactical courses of action is to develop the courses of action to be analyzed. These courses of action may be provided by the division commander in his guidance to the staff following mission analysis, or they may be developed by the division G3 and his staff.

PROCEDURE

Review the division commander's guidance carefully as a basis for your analysis of the tactical courses of action. If the commander has not specified the courses of action he wants considered and has designated you to do so, then follow the guidance in FM 101-5 and ST 100-9 (para. 3-4) in developing courses of action.

Make tactical overlays for each course of action identified.

After you have reviewed the courses of action described in the division commander's guidance, you may proceed to Step 1.

Step 1

Review Area of Interest and Gather Facts (METT-T)

DESCRIPTION

To develop an appreciation of the tactical situation, the staff considers facts it needs to support planning and to properly advise the commander. The information pertains to both friendly and enemy forces as well as to the area of operations (terrain and weather). Key facts are recognized and recorded to support the planning effort.

PROCEDURE

Carefully select that information which will assist you most in the analysis of the tactical courses of action and in developing the operation estimate. Such information will come from the battlefield information available to you, from other staff elements, and from higher and subordinate commands. As you review the information, select those facts which are most important and which you need to keep foremost in your mind during your planning effort. Record these facts in the List of Pertinent Facts worksheet. A convenient organization of these facts is METT-T. Additional facts may be added as planning progresses.

After reviewing the available information and listing the pertinent facts on the List of Pertinent Facts worksheet, you may proceed to Step 2.

List of Pertinent Facts

MISSION

ENEMY

TERRAIN AND WEATHER

OWN TROOPS AVAILABLE

TIME

Step 2

List Assumptions

DESCRIPTION

In the step-wise process of analyzing tactical COAs, you next develop assumptions to replace necessary but missing facts.

PROCEDURE

The assumptions, as well as the rationale for making those assumptions, are to be entered on the List of Assumptions Worksheet. Refer to ST 100-9 for guidance in making assumptions. After listing the assumptions and rationales, analyze how they may affect your planning, and keep them in mind as you complete the exercise.

After developing the assumptions and the associated rationale, you may proceed to Step 3.

List of Assumptions

Assumptions	Rationale (Why assumption is necessary)

Step 3

Array Forces for Each COA

DESCRIPTION

You will next allocate the available forces which you believe are necessary to successfully execute each COA. You should task organize the division force with adequate combat power allocated to the main attack, supporting attack, and reserve for mission accomplishment.

PROCEDURE

In accomplishing this step you will complete a Task Organization Worksheet (following pages) for each COA. Each worksheet is labeled by COA number in the upper right-hand corner.

Starting with COA 1, select the enemy units which oppose each of the main and supporting attacks, and enter them in the corresponding space in the worksheet. Next, select the enemy units which you consider to be reserve or second echelon forces and enter them in the worksheet.

Next, select and task organize the friendly units which you plan to use to conduct the main and supporting attacks and enter them in the worksheet. Similarly, select the friendly units which you plan to place initially in reserve and enter them in the worksheet. If you want to calculate precise combat power ratios, refer to tables on U.S. versus Soviet combat unit comparison values in ST 100-9.

When you have completed the Task Organization Worksheet for COA 1, repeat the process for all other COAs to be analyzed.

After you have completed a Task Organization Worksheet for all COAs, you may proceed to Step 4.

COA___

Friendly	Enemy
Main Attack	
Supporting Attack	
Reserve	

Step 4

Determine Critical Events

DESCRIPTION

In accomplishing this step, you will identify and list critical events appropriate for each COA. Critical events are defined as those specified or implied tasks the completion of which are essential to mission accomplishment and which, in the judgment of the analyst, require detailed analysis. In order to develop a critical events list, the analyst must have a mental picture of how the battle will be fought for each COA. There will be times when the list of critical events and decision points may be too long to manage. The analyst must then reduce the list to one that is manageable in the time available for war-gaming. This process requires military judgment to determine which have the highest probability of changing the outcome of the battle and then to restrict the war-gaming to only those critical events.

PROCEDURE

The first step is to select a war-gaming technique. The standard war-gaming techniques are described on the following page. You may use any one of these or some combination, but if you choose the box technique, it must be equally applied to all COAs to permit comparison. The selection of a war-gaming technique at this point is required because it will determine how the CEs are labeled.

In determining the CEs, you will use the map and tactical overlay for each COA as well as a CE Assignment Worksheet for each COA. A listing of candidate critical event types appears on the following page.

Post the tactical overlay for the COA which you desire to consider first. Assuming this overlay is for the COA which has been identified as COA 1, conduct a map and tactical overlay review and select the first critical event which you expect to occur either along the main axis/avenue or in the first belt. Circle that CE with a grease pencil or marker and label it 1A1 inside the circle. Next, enter the corresponding CE identification on the CE Assignment Worksheet. For each CE entered in the worksheet, identify the CE by type (see list of CE types or identify your own) and by objective. Enter any desired comments in the worksheet. Following the same procedure, select other CEs, label them on the tactical overlay as 1A2, 1A3, etc., and identify them in the CE Assignment Worksheet. For CEs on a supporting attack or secondary avenue or in the second belt, label the CEs as 1B11, 1B12, etc. (For a third supporting attack/avenue or belt, CEs would be labeled 1C21, 1C22, etc.)

For the COA identified as COA 2, replace the COA 1 tactical overlay with the overlay for COA 2, and repeat the process of selecting and labeling the CEs on the tactical overlay and of identifying the CEs in the CE Assignment Worksheet. For the main attack axis/avenue or first belt of COA 2, label the CEs as 2A1, 2A2, etc. For CEs on the supporting attack axis, or second belt, label the CEs as 2B11, 2B12, etc.

Continue this process for all COAs. It is recommended that all CEs be identified even if the box technique is chosen. In this way, all CEs are considered in selecting the most crucial one(s).

After you have completed the CE identification on the tactical overlays for both COAs and have completed the CE Assignment Worksheet, to to Step 5.

War-Gaming Techniques

Avenue in depth

Focus on each avenue starting with the main attack

Analyze successive critical events along the avenue

Casualties and resource expenditures are totaled across all avenues

FEBA movement and battle duration apply to the main attack only

Belt

Divide battlefield into belts generally parallel to the FEBA and spanning the sector

Critical events are analyzed by successive belts

Casualties and resource expenditures are totaled for all belts

FEBA movement and battle duration are totaled only for those critical events along the main attack

Box

A box is drawn around a small number of critical events

Used to abbreviate the analysis due to time constraints

Assumes other critical events do not impact selection of preferred COA

Critical Event Type Examples

Offensive Missions

Passage of Lines
Penetrate First Defensive Belt
Penetrate Second Defensive Belt
Breach Obstacle Belt
Cross River
Seize Objective
Seize Key Terrain
Seize Town
Defeat Enemy Counter-Attack
Destroy Enemy Force
Capture Enemy Force
Bypass Enemy Force
Seize Beachhead
Fix Enemy in Position
Synchronize with Supporting Forces

Critical Event Assignment Worksheet

COA _

CE Identification (Axis/Avenue Seq No)	Critical Event Type	Objective	Comment
MAIN ATTACK/AVENUE OR FIRST BELT			
SUPPORTING ATTACK/ AVENUE OR SECOND BELT			

Step 5

War-Game the Courses of Action

DESCRIPTION

War-gaming of tactical courses of action may be divided into successive tasks which will facilitate the gaming process and which may be expected to yield results which will support your selection of a preferred course of action. The war-gaming tasks discussed correspond to those contained in CGSC ST 100-9. You will need to select war-gaming measures to be used to quantify and analyze the results of battle engagements of each critical event. Your final task in this step is to visualize the battle for each critical event selected. Based upon your visualization of the battle at each critical event, you will make assessments for each of the war-gaming measures you previously selected, and you will record the results for later analysis.

PROCEDURE

You will war-game each COA using a technique of your choice and will assess the battle results. War-gaming of a COA will proceed critical event-by-critical event, and you will record your battle assessments in a CE War-Gaming Worksheet. Your war-gaming of the critical events will be based upon the facts, assumptions, force arrays, and critical events available to you.

For purposes of completing the CE War-Gaming Worksheet, critical event phases are as follows:

Phase A: Actions before the actual critical event. (Usually these actions are those after the consolidation phase of the preceding CE up to the new critical event.)

Phase B: Actions during the critical event.

Phase C: Actions taken upon completion of the critical event (e.g., consolidation, reorganization).

You may war-game at either phase level or CE level. If you war-game at CE level, aggregate your assessments as Phase B.

(Continued)

To perform the war-gaming activity, you will complete a CE War-Gaming Worksheet for each CE by COA. The CE War-Gaming Worksheet identifies the CE being gamed, divides the CE into three phases discussed above, and offers eight objective war-game measures for the assessment of battle outcome. You need not use all eight measures, but you should use those which provide a good indication of battle outcome for the CE.

Make the war-game assessments using the measures you select for this purpose and enter the results into the appropriate column of the CE War-Gaming Worksheet. If you have divided the critical event into phases, assess each phase separately. Assessments should be made carefully and consistently as they will be added in a later step. Suggested units of measure are:

Personnel losses	Numbers of persons
Equipment losses	Numbers of major equipment items*
POL expended	Percent of division authorized load
Ammo expended	Percent of division basic load
FEBA movement	Kilometers
Battle duration	Hours and tenths of hours

*See following page for suggested major equipment items.

Repeat the process above until all CEs used have been war-gamed and the battle assessments have been made.

When you have made the war-game assessments for all critical events analyzed for each COA, you may proceed to Step 6.

Example
Major Equipment Items For War-Gaming COAs

BLUEFOR	OPFOR
TANK, M1	BMP
Infantry fighting vehicle (IFV) M2	BTR
Cavalry fighting vehicle (CFV) M3	BRDM-GM
Improved TOW vehicle (ITV)	Howitzer, 122mm (Towed or SP)
Howitzer 155mm M109	Howitzer, 152mm (Towed or SP)
Howitzer 203mm M110	Multiple rocket launcher 122mm
Multiple launch rocket system (MLRS)	Tank (T64, T72, T80)
Attack helicopter AH-64	Gun AT, 100mm
	Assault helicopter MI-8
	Attack helicopter MI-24

War-Gaming Worksheet For Each Critical Event

COA ___ Critical Event: CE Type/Objective:

Phase	War-Game Assessment Measures							
	Fr Pers Losses	Fr Equip Losses	En Pers Losses	En Equip Losses	POL Expended	Ammo Expended	FEBA Mvmt	Battle Duratic
Phase A - Pre-Critical Event								
Phase B - Critical Event								
Phase C - Consolidation								
CE Total								

Step 6

Aggregate and Scale Battle Results for Each COA

DESCRIPTION

Once all critical events have been war-gamed, and the battle assessments for each CE have been made, you will aggregate and analyze the results as a means of disclosing from an objective standpoint which alternative tactical course of action is the better or best.

PROCEDURE

In the performance of this step, you will translate the battle assessments for each CE (Step 6) onto War-Gaming Summary Worksheets, one for each COA. You will then total the assessments and scale the totals for goodness.

First, from the CE War-Gaming Worksheets completed in Step 6, bring forward the assessments made and enter them in the War-Gaming Summary Worksheet for the appropriate COA. For those war-game assessment measures which you used, total the assessments for each measure for each COA. Remember that the battle duration and FEBA movement are a function of the main attack only.

The next step is to assess the goodness of the assessments which you have made. To do this, consult the Scaling Factors Table (Objective Measures) and enter an appropriate scale number for the total assessments for each measure used. As an example of scaling, and using a scale of 1-to-9 (9 is good), very low friendly personnel casualties would elicit a scaling of 9 for goodness. On the other hand, very high enemy casualties would also be scaled 9 as viewed by the friendly commander. In the absence of weighting across assessment measures, a summation of the goodness for each COA would yield an initial preference for COA selection.

The final action required of you in this step is to review the raw assessment scores and the scaling and to generally compare the COAs. A more detailed and specific comparison, including consideration of other factors, will occur in Step 7.

When you have reviewed the battle assessments and scaling in the War-Gaming Summary Worksheet, you may proceed to Step 7.

Scaling Factors Table (Objective Measures)

Factor	Scale	Value
Friendly Personnel Losses (percent)	9	<2
	8	2-4
	7	4-6
	6	6-8
	5	8-10
	4	10-12
	3	12-14
	2	14-16
	1	>16
Friendly Equipment Losses (percent)	9	<10
	8	10-18
	7	18-24
	6	24-29
	5	29-34
	4	34-38
	3	38-41
	2	41-43
	1	>43
Enemy Personnel Losses (percent)	9	>16
	8	14-16
	7	12-14
	6	10-12
	5	8-10
	4	6-8
	3	4-6
	2	2-4
	1	<2
Enemy Equipment Losses (percent)	9	>43
	8	41-43
	7	38-41
	6	34-38
	5	29-34
	4	24-29
	3	18-24
	2	10-18
	1	<10

Factor	Scale	Value
POL Expended (percent auth load)	9	<50
	8	50-90
	7	90-125
	6	125-150
	5	150-170
	4	170-180
	3	180-190
	2	190-200
	1	>200
Ammo Expended (percent basic load)	9	<50
	8	50-90
	7	90-125
	6	125-150
	5	150-170
	4	170-180
	3	180-190
	2	190-200
	1	>200
FEBA Movement (km)	9	>38
	8	36-38
	7	34-36
	6	31-34
	5	28-31
	4	24-28
	3	18-24
	2	10-18
	1	<10
Time (hours and tenths)	9	<24
	8	24-26
	7	26-29
	6	29-32
	5	32-36
	4	36-42
	3	42-50
	2	50-60
	1	>60

COA ____

War-Gaming Summary Worksheet

Critical Event	War-Game Assessment Measures							
	Fr Pers Losses	Fr Equip Loss	En Pers Losses	En Equip Loss	POL Expended	Ammo Expended	FEBA Mvmt	Battle Duratic
Main Attack/Avenue or First Belt CE# Name								
Main Attack Total								
Supporting Attack/Avenue or Second Belt CE # Name								
Supporting Attack Total								
COA Total								
Scale (see Table)								

Step 7

Compare Courses of Action

DESCRIPTION

To this point in the exercise you have been concerned with those objective measures which may be used to compare COAs. Objective measures are amenable to measurement or quantification. You will now identify subjective measures to be considered in comparing COAs. Subjective measures are not amenable to quantification but must be applied judgmentally. Finally, you will integrate the subjective measures with the objective measures to yield a more expansive basis for comparing COAs and for selecting the preferred COA.

PROCEDURES

In performing this step, you will perform several tasks and will integrate the results using the COA Comparison Worksheet.

The first task is to identify subjective measures which you believe should be considered in selecting a preferred course of action. Subjective Measures Examples are provided on a following page to give you an appreciation of typical subjective measures. You will next scale the selected subjective measures for goodness to the degree they are each exhibited in each COA.

The next task is for you to establish relative weights among the objective and subjective measures, and this is a matter of military experience and judgment. The weight assigned to each measure reflects the relative influence which each measure has upon your evaluation of the merit of the courses of action under consideration. In the COA Comparison Worksheet, assign a weight of 100 to that measure or factor which you judge has the greatest influence upon your selection of a preferred course of action. For example, if conserving friendly equipment for the purpose of conducting future operations is the most important, assign to that objective factor the value of 100. On the other hand, if your judgment reveals that flexibility of the planned COA is the most important factor, then assign that subjective factor the optimum value of 100. All other objective and subjective factors are then weighted in relationship to the one most important factor, and each is assigned a weight less than 100.

(Continued)

The next task is for you to scale the subjective measures for the degree to which each is incorporated in or supported by each COA under consideration. Scaling tables are provided to guide you in the performance of this task. Remember when you are scaling the subjective factors that the measures will rarely be exhibited with equal goodness in each COA; thus, different scales values will typically be assigned to each COA for any one measure being considered. Enter your selected scale value in the scale column for each COA. In scaling the subjective factor risk, a COA with the lowest risk should be scaled 9 while the one with the highest risk should be scaled 1.

Next, from the War-Gaming Summary Worksheet (Step 7), bring forward the scaled values of the objective measures for each COA and enter them in the scale columns of the COA Comparison Worksheet.

Next, for both objective measures and subjective measures, multiply the assigned weights of each measure by the scale value assigned each measure and enter the result in the appropriate column of the COA Comparison Worksheet. This arithmetic operation must be accomplished for both objective and subjective measures and for all courses of action. Sum the result columns of the COA Comparison Worksheet for each COA to yield the relative influence of objective and subjective measures on the selection of the preferred COA.

The last task of this step is to analyze the aggregated objective and subjective measures for each COA and to consider their influence on your selection of a recommended COA. The results of your analysis will be used to justify your recommendation of a COA in Step 8.

When you have completed the COA Comparison Worksheet you may proceed to Step 8.

Principles of War:	AirLand Battle Tenets:
Objective	Initiative
Offensive	Agility
Mass	Depth
Economy of Force	Synchronization
Maneuver	**Other:**
Unity of Command	Flexibility
Security	Mutual Support
Surprise	Facilitate Future Operations
Simplicity	

Scaling Factors Table
(Subjective measures less risk)

Degree that the measure is supported by, or incorporated in, the COA:

9	High
8	
7	Moderately high
6	
5	Moderate
4	
3	Moderately Low
2	
1	Low

Scaling Factors Table
(Risk)

Degree that the measure is incorporated in the COA:

9	Low risk
8	
7	Moderately low risk
6	
5	Moderate risk
4	
3	Moderately high risk
2	
1	High risk

Analysis Category	Weight	COA ___		COA ___	
		Scale	Result	Scale	Result
Objective Measures					
Friendly personnel losses					
Friendly equipment losses					
Enemy personnel losses					
Enemy equipment loss					
POL expended					
Ammo expended					
FEBA movement					
Battle duration					
Objective Measures Total					
Subjective Measures					
Subjective Measures Total					

Step 8

Justify Recommended COA

DESCRIPTION

You have now completed the war-gaming of each COA and have analyzed the alternative courses of action both objectively and subjectively. You will now exercise your military judgment and experience to complete the comparison of the COAs and to select a preferred course of action.

PROCEDURES

In this step, complete the COA Selection and Justification Worksheet. Completion of this worksheet will guide you to the major factors which will influence your selection and recommendation of a preferred tactical course of action.

For the alternative courses of action, identify and list the advantages and disadvantages of each course of action using the COA Selection and Justification Worksheet.

After you have listed the advantages and disadvantages of the respective courses of action, analyze and evaluate them and produce a narrative which compares the courses of action from the objective and subjective information available. What you are doing in this task is justifying the selection of one course of action over the others. There can be no ties; the commander is looking to you to discriminate between the alternative courses of action based upon the information available and upon your professional judgment. The narrative should be stated in sufficient detail to convince the commander of the recommended COA.

After you have completed your analysis and comparison, enter your recommendation of the preferred tactical course of action at the bottom of the worksheet.

When you have completed the COA Selection and Justification Worksheet, you may proceed to the next task.

COA Selection and Justification Worksheet

	Advantages	Disadvantages
COA ____		
COA ____		
COA ____		

COA Selection and Justification Worksheet (Cont.)

Narrative comparing advantages and disadvantages:

Recommended COA:

Next Task

Develop Operation Order or Plan

DESCRIPTION

Having selected a preferred course of action, the next step is to obtain approval and to translate that course of action into an operation order for implementation by major subordinate commands of the division.

Working Paper

WP LVN-88-2

BATTLE SCENARIOS TO EXERCISE DIVISION STAFFS:
EXAMPLE STAFF PRODUCTS

Charles F. Carter, Jr., C. Glen Ross,
Science Applications International Inc.

Rex R. Michel and Jon J. Fallesen,
US Army Research Institute

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333

March 1988

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EXAMPLE STAFF PRODUCTS

The Fort Leavenworth Field Unit of the Army Research Institute is engaged in behavioral science research to improve Army command and control (C2). A primary focus is on the development and evaluation of procedures and techniques which allow the staff officer to take advantage of various computer-based C2 systems which are being fielded by the Army. The Field Unit research program, and related efforts being conducted elsewhere in DOD, must start from a thorough understanding of the way C2 tasks are accomplished today; we must know the baseline condition before we can develop and evaluate alternatives. This document describes the actions to be taken and the products to be prepared by division-level G2 and G3 staff officers when involved in operations planning. The example products are presented in the tactical context of the offensive scenarios described in Fallesen, Michel, Carter and Ross[1].

In the normal exercise of command and control of Army tactical operations, the command group will perform doctrinally-specified staff planning activities. These staff planning activities are described in such Army publications as Field Manual (FM) 100-5, <u>Operations</u>; FM 100-10, <u>Combat Service Support</u>; FM 100-15, <u>Corps Operations</u>; FM 101-5, <u>Staff Organization and Operations</u>; USACGSC Student Text 100-9, <u>The Command Estimate</u>; and similar publications and documents. These publications provide <u>what</u> staff actions should be performed by command group elements but provide very little of <u>how</u> the staff actions are to be executed. Military service school curricula often address <u>how</u> these staff planning functions are to be performed and performed effectively, and many classroom hours are devoted to staff planning exercises.

This report pulls together the <u>what</u> and <u>how</u> of staff actions in the referenced tactical scenarios. Actions described include functional activities for intelligence and operations and staff interactions between the G2 and G3 staff. The procedures are documented in Appendix A.

An example division intelligence estimate is included as Appendix B. This estimate can be used as a baseline to which the G2 player's performance can be compared. The intelligence estimate analyzes the characteristics of the area of operations and the enemy situation to determine the extent to which they can affect the accomplishment of the mission. This estimate draws conclusions and makes recommendations, as appropriate, concerning the effect of the area of operations on friendly and enemy forces, probable enemy courses of action, enemy vulnerabilities which can be exploited, and the feasibility of various friendly courses of action.

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[1]See Fallesen, J. J., Michel, R. R., Carter, Jr., C. F., and Ross, G. C. (in preparation). Battle Scenarios to Exercise Division Staffs. ARI Draft Research Product. Alexandria, VA: ARI.

A copy of a division operation estimate is included as Appendix C. This estimate also can be used as a baseline for performance assessment. The operation estimate analyzes factors affecting the accomplishment of the tactical mission to determine all reasonable courses of action and the effect of these courses of action on friendly forces. This estimate recommends a course of action for accomplishing the mission.

A division operation order was developed with the intelligence annex and a reduced version of the operation overlay. The operation order and the intelligence annex to that order are included as Appendix D. Operation orders provide for coordinated action to carry out the decision of a tactical commander in the conduct of an operation. Operation orders review the tactical situation; identify the mission; develop schemes of maneuver, supporting fires, and other battle execution schemes; assign missions to organic and supporting forces; provide for service support; and furnish command and signal instructions. Operation orders clearly reflect the tactical commander's battle plan.

This report provides a baseline description of what G2 and G3 staff officers do during operations planning, how they do it, and the products they produce in the context of the referenced battle scenarios.

APPENDIX A

DIVISION INTELLIGENCE AND OPERATIONS STAFF PROCEDURES

INTELLIGENCE STAFF FUNCTION

1.0 GENERAL

The intelligence staff officer (G2) is responsible for obtaining and analyzing information relating to his assigned staff functional area. The purpose is to provide the commander and other staff officers with relevant information (processed and synthesized) as required for staff estimates and commander's decisions. The G2 is responsible for the following types of information:

- Terrain - the analysis of the area of operations and area of interest; the effect of terrain on courses of action, to include potential enemy modifications of the terrain; and the effect of weather on terrain;
- Weather - the forecasted weather and the impact of weather on courses of action;
- Enemy situation - the disposition, composition, and strength of committed, reinforcing, and supporting forces; recent significant activities within the area of interest; and any weaknesses and peculiarities of the enemy forces;
- Enemy courses of action - the courses of action available to the enemy which he has the capability to undertake, an analysis of those courses of action, a ranking of them according to their probability of adoption, and enemy reaction to each friendly course of action;
- Friendly status - intelligence asset status and capabilities;
- Intelligence requirements - priority intelligence requirements (PIR), information requirements (IR), named areas of interest (NAI), and target areas of interest (TAI);

The G2 prepares his estimate based on the commander's restated mission and planning guidance. The estimate process is normally continuous, with staff officers exchanging information as their estimates develop. The ultimate purpose of the estimate process is to provide information and make recommendations to the commander for his use in reaching a decision as to the best course of action for accomplishing a particular mission.

Doctrinally the G2 uses a methodology called intelligence preparation of the battlefield (IPB) to perform his analysis and prepare his estimate. The IPB process is a five function cyclical process:

- Battlefield area evaluation
- Terrain analysis
- Weather analysis

- Threat evaluation
- Threat integration

IPB provides a systematic approach to analyzing the enemy, terrain, and weather in a specific geographical area. IPB integrates enemy doctrine, training, and available intelligence information with the terrain and weather information to determine enemy capabilities, vulnerabilities, and probable courses of action. IPB aids the commander and staff in predicting enemy vulnerabilities and friendly opportunities. It provides the means for comparing friendly and enemy capabilities and it assists the commander in determining when, where, and how to employ his resources to best accomplish the mission.

2.0 STAFF FUNCTIONS

Commanders base their plans and actions on estimates of enemy capabilities and the relative probability of their adoption. Enemy capabilities can be estimated objectively when they are based on a complete and thorough knowledge of the area of operations, enemy situation, enemy doctrine, time and space factors, and pattern analysis. The intelligence (G2) staff is responsible for providing this understanding to the commander and other staff members. Figure 1 provides a schematic of the primary intelligence staff functions. Each of these functions is discussed in the following paragraphs.

2.1 INTELLIGENCE MISSION ANALYSIS

Mission analysis is the process by which the commander, assisted by his staff, determines what specified and implied tasks must be performed and what contraints or limits apply to the given mission. The intelligence mission analysis is fundamentally different from that of other staff officers in that it focuses on the enemy and the environment and is basically a preliminary intelligence estimate. The G2 uses the available information to make a general assessment of the threat and the area of interest which has been defined by the G3. The threat evaluation includes composition, strength, disposition, equipment, and doctrine. This results in an initial order of battle (OB) and statement of enemy capabilities and also identifies additional information requirements. The area of interest is examined using the available terrain and weather data to form a preliminary assessment of their impact on both friendly and enemy capabilities. This assessment also reveals areas where additional data are required.

In the terms of the IPB process the mission analysis equates to the battlefield area analysis function. Battlefield area evaluation is the function of preliminary analysis of available data and the definition of requirements for additional information. This step includes defining the area of influence and area of interest of the command (in coordination with the G3), collecting the available information (maps, demography, climatological data, etc.), the preliminary analysis of these items, and the identification of additional data required for the detailed analysis of the area.

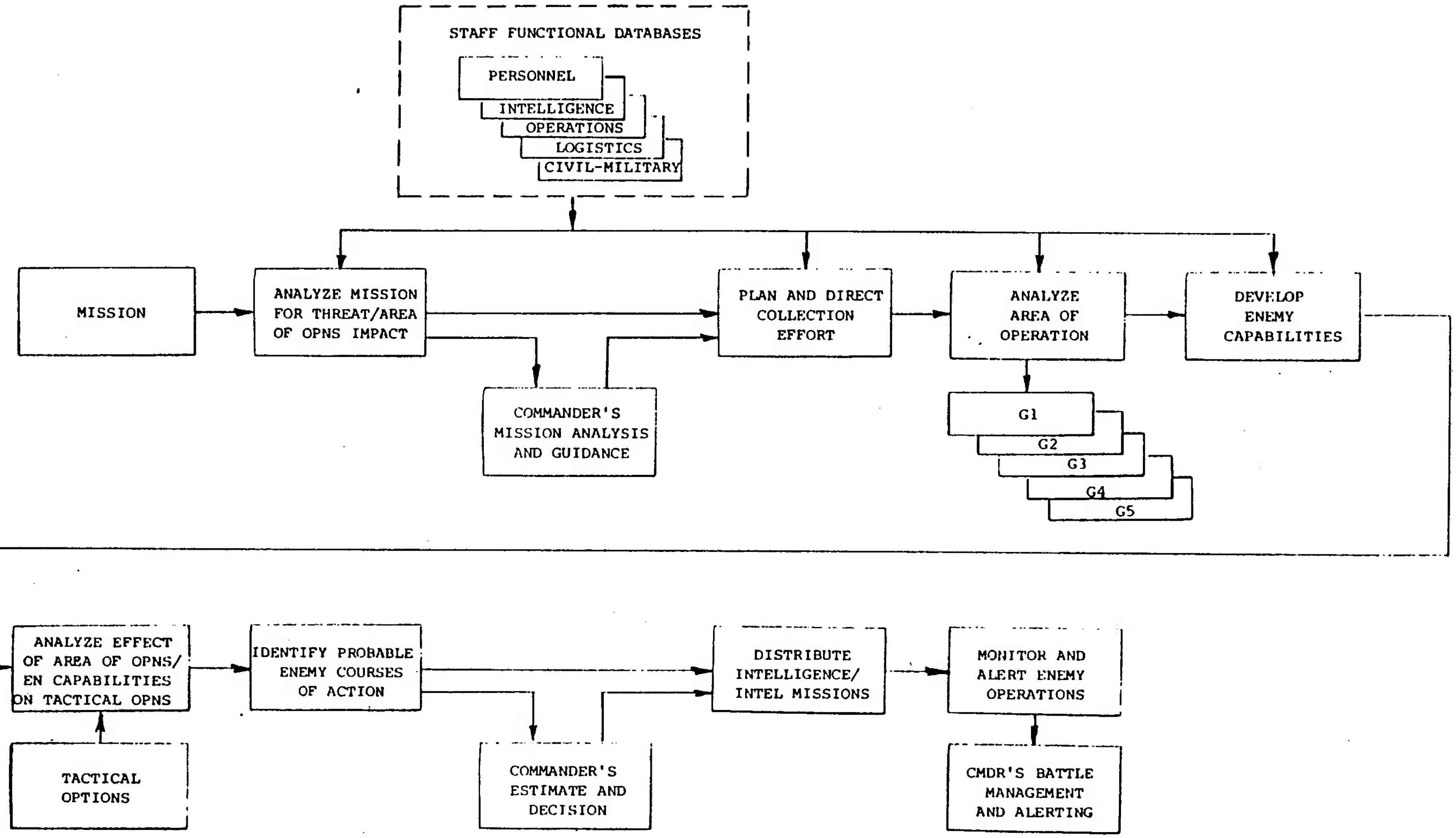


Figure 1. INTELLIGENCE STAFF FUNCTIONS

2.2 INTELLIGENCE INFORMATION COLLECTION

Corps and division levels have many diverse intelligence collection agencies available to them. Detailed planning and tasking of these agencies is required if the maximum benefit of their capabilities is to be realized.

The intelligence collection plan is the means that the G2 uses to enumerate the collection requirements and assign collection responsibilities. The commander's intelligence requirements, announced in his planning guidance, and any other requirements identified during the mission analysis phase are analyzed to determine indicators which would assist in satisfying the requirement. The primary tool used by the G2 in this effort is the event template developed as a part of the threat integration step of the IPB process.

The event template shows where critical events and activities are expected to occur and where critical targets may appear. It is used to predict time-related events throughout the area. The event template provides the basis for collection planning, prediction of enemy intentions, and for acquiring and tracking high value targets (HVTs).

Indicators, or enemy activities which will occur if a particular course of action is chosen, are translated into specific mission requests for collection agencies. Orders and requests to collection agencies are specific as to what information is required, where it may be found, and where and when it must be reported. Time is critical to the collection effort. Information which becomes available too late to influence friendly actions is of little benefit. The collection effort requires close and continuous supervision by the intelligence staff in order to ensure success and to have a beneficial influence on the tactical operation planning and execution.

2.3 ANALYSIS OF THE AREA OF OPERATIONS

The analysis of the area of operations has the purpose of determining the effect of the area on the courses of action that either friendly or enemy forces may adopt. This analysis allows the commander and staff to see the battlefield in depth, width, height (airspace), and time. In addition to terrain and weather this analysis includes the sociological, political, economic, religious, materiels, transportation, and science and technology aspects of the area.

Terrain analysis is concerned with the military aspects of terrain and its effect on both friendly and enemy courses of action (their capability to move, shoot, and communicate). The military aspects of terrain are: observation and fields of fire, cover and concealment, obstacles, key terrain, and avenues of approach/mobility corridors. They are generally referred by the acronym OCOKA. The G2 will normally produce a number of graphic products for use internally and by other elements of the staff in developing estimates. The terrain analysis is highly dependent on weather and must, therefore, be conducted together with the weather analysis.

The weather analysis is a look at the climate and weather in the AO and its effect on the terrain, as well as on personnel and equipment capabilities of both sides. Due to the effect that weather has on terrain, their analysis must be highly integrated.

Figure 2 provides a graphical representation of the functions performed in terrain and weather analysis. These functions are discussed in the following subparagraphs.

2.3.1 Terrain Analysis

An analysis of the terrain in the area of operations/area of interest is essential to effective tactical planning. Standard topographic maps provide considerable detailed information about the terrain; however, the map data must be supplemented from other sources to be complete. Other sources include, but are not limited to, engineer terrain studies and topographic analyses, hydrographic studies, observation and reconnaissance reports, radar and imagery reports, and aerial photography and photo interpretation reports. Terrain analysis is highly mission dependent and is focused on the influence of terrain on both friendly and enemy operations. This analysis should allow the commander and staff to determine where the forces (both sides) can move, shoot, and communicate and, therefore, the best place to employ his own forces to maximize their potential and exploit enemy weaknesses.

Each of the subfunctions of terrain analysis, as depicted in Figure 2, is discussed below.

a. Development of the terrain factor matrix. The terrain factor matrix provides a guide for the terrain analysis. The matrix is developed through an analysis process whereby terrain factors that impact on combat operations are identified and correlated with specific types of combat operations and battlefield functions. The terrain factor matrix assists the intelligence analyst in identifying the types of terrain products needed for the analysis. A typical terrain factor matrix appears in Figure 3.

b. Development of terrain factor overlays. Analysis of the military aspects of terrain (OCOKA) is facilitated through the preparation and analysis of terrain factor overlays.

   Terrain factor overlays supplement the information provided by the standard topographic maps. The following examples are typical of such overlays.

   - Hydrography overlays which depict rivers and streams. These overlays may also include, or be supplemented by, water area overlays which depict lakes, swamps, and bogs.

   - Lines of communication (LOC) overlays which depict the primary and secondary roads and railroads in the area.

   - Slope overlays which portray predetermined terrain slopes which will hinder or impede traffic in the area.

   - Vegetation overlays which highlight forests, brush, or other types of vegetation as desired.

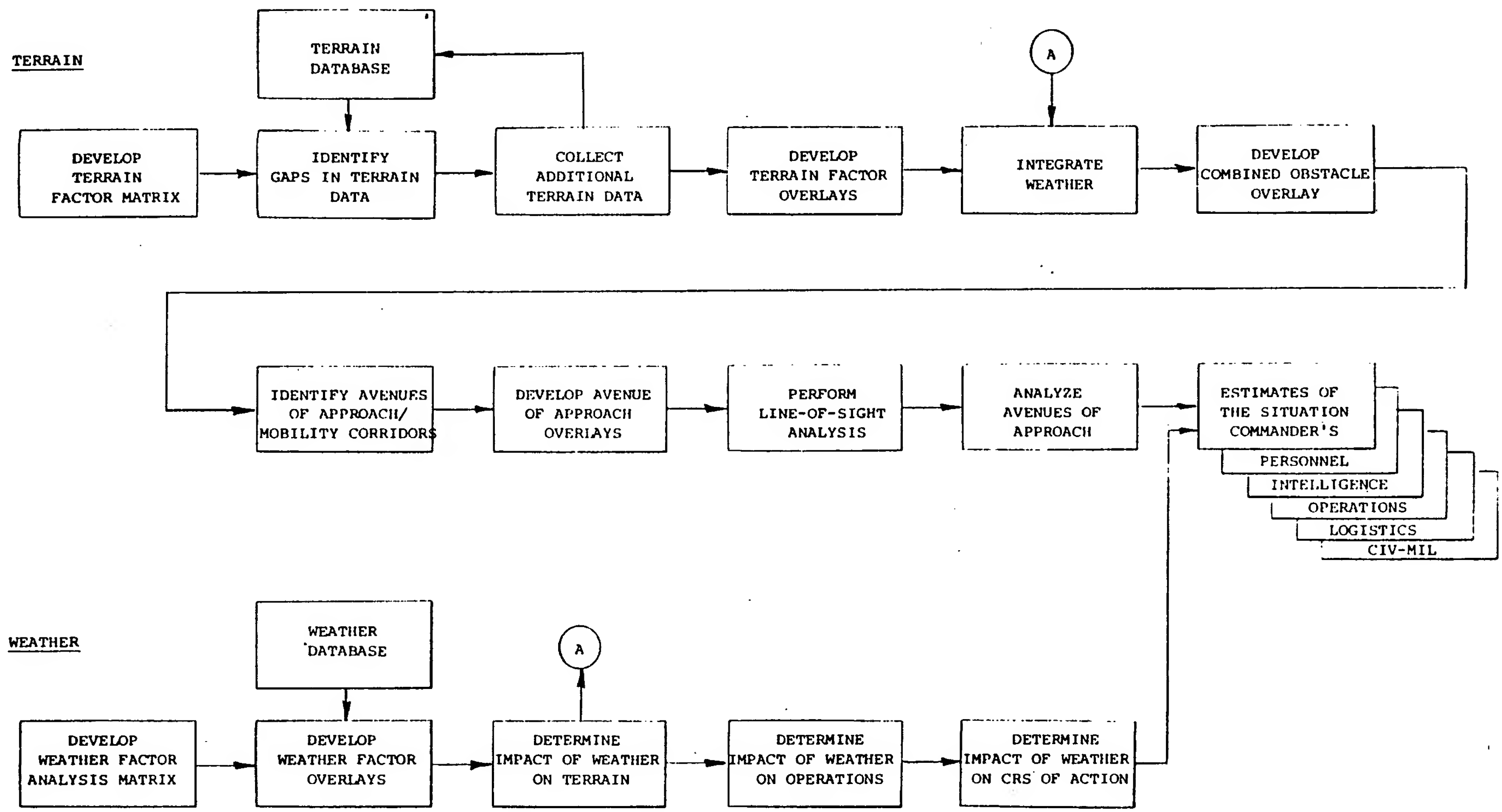


Figure 2. Analysis of the Area of Operations

	Factors							
Functions	Surface Configuration	Soils	Vegetation	Slope	Built-up Areas	Precipitation (1)	Roads/trails	Hydrography
Observation and Fields of Fire	X		X		X	X		X
Concealment and Cover	X		X		X			X
Obstacles	X	X	X	X	X	X		X
Key Terrain	X						X	
Ground Avenues of Approach	X	X	X	X	X	X	X	X
Air Avenues of Approach	X		X					X
Weapon Sites	X	X	X	X	X			X
DZ and LZ	X	X	X	X				X
Maneuver	X	X	X	X	X		X	X
LOC and MSR				X	X		X	X
Barriers and Fortifications	X	X	X	X	X		X	X
Line-of-Sight	X		X		X			X
Communication Sites	X		X		X			X
EW Sites	X		X		X			X

(1) Weather Input

Figure 3. TERRAIN FACTOR MATRIX

- Elevation overlays which depict changes in elevation and are vital to the identification of avenues of approach/mobility corridors as well as intervisibility studies.

- Mobility overlays which depict the cross-country trafficability, particularly for wheeled and/or tracked vehicles.

- Built-up area overlays which outline and code city and town perimeters.

c. Development of combined obstacles overlay. Obstacles canalize cross-country movement and must be considered carefully when planning tactical operations. The combined obstacles overlay facilitates the identification of natural obstacles and assists in the planning of man-made obstacles for maximum effect.

Selected terrain factor overlays (see paragraph 2.3.1.b above) can be stacked and registered to create a combined obstacles overlay (as shown in Figure 4) depicting the natural terrain obstacles of the area. These overlays contribute to the analysis of avenues of approach and mobility corridors. The effects of weather on terrain must be considered and integrated into this analysis. The inclusion of weather effects provides a picture of the average weather-induced conditions and depicts seasonal variations on mobility.

d. Identification of avenues of approach. Avenues of approach are routes by which a force may reach an objective or key terrain. The term is applicable to both friendly and enemy forces. Avenues of approach are identified and evaluated in terms of:

- Potential to suport maneuver

- Access to the objective and adjacent avenues

- Degree of canalization

- Cover and concealment

- Observation and fields of fire

- Obstacles

Avenues of approach include mobility corridors, which are areas that allow the doctrinal movement and maneuver of a specified size force (generally one level below that of the force accomodated by the avenue). Doctrinal templates, prepared as a part of the IPB process, provide the basis for integrating the enemy doctrine and training with the terrain and weather of the area. Doctrinal templates depict the doctrinal deployment (to scale) of the threat forces for various types of operations with no constraints imposed by the weather and terrain. They show formations, composition, frontages, depths, and equipment numbers and assist in identifying high value targets. They assist in determining mobility corridors by imposing them over the combined obstacles overlay to determine where sufficient maneuver space exists

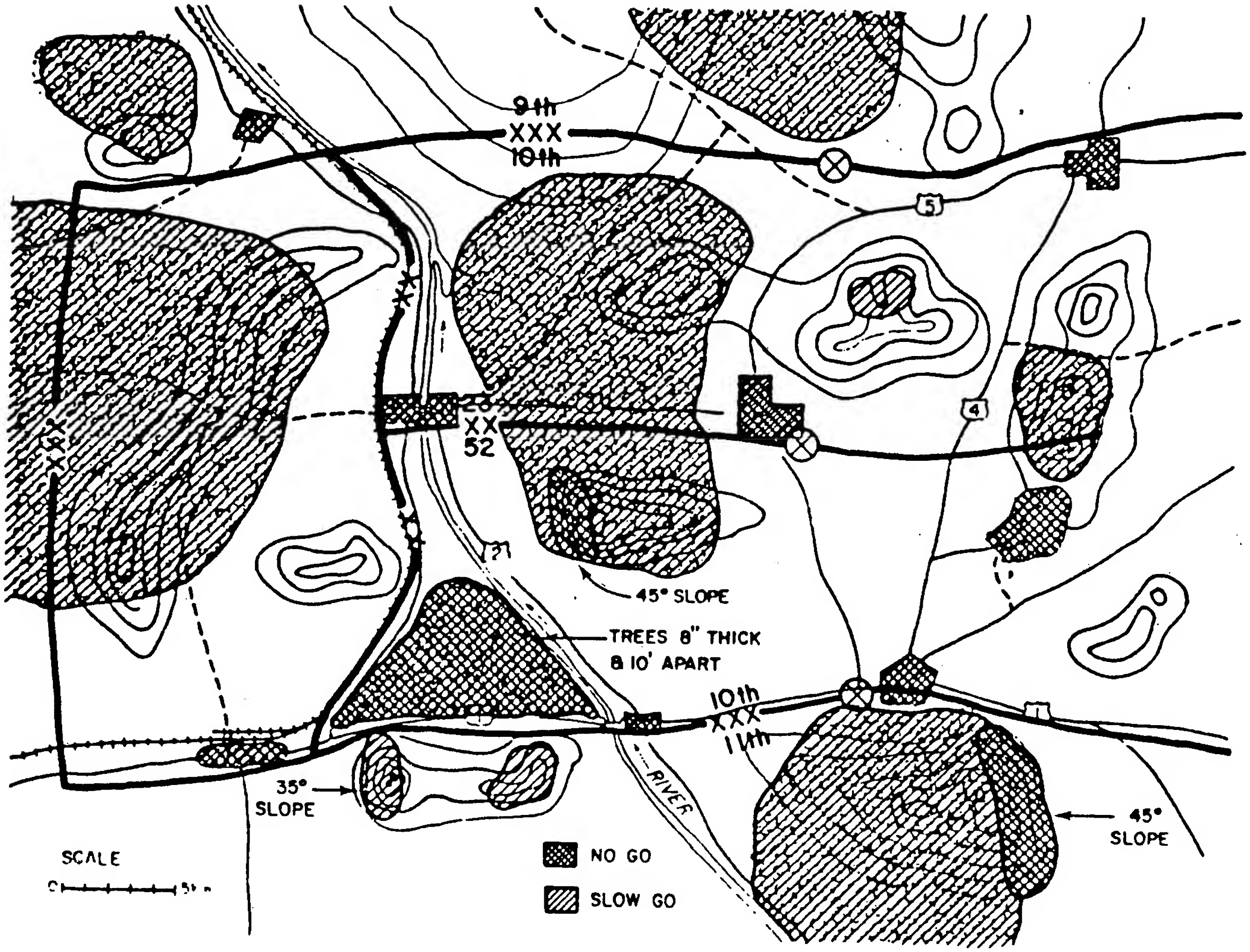


Figure 4. SAMPLE COMBINED OBSTACLES OVERLAY

for a given force. Figure 5 provides an example of the selection and designation of mobility corridors.

Once the mobility corridors have been identified, then the most viable avenues of approach can be selected. A viable avenue of approach should contain at least two mobility corridors. Figure 6 depicts the division avenues of approach corresponding to the mobility corridors shown in Figure 5.

e. Line-of-sight analysis. Intervisibility or line-of-sight (LOS) determination for weapons, communications, target acquisition, intelligence, and reconnaissance and surveillance systems must be considered for each mobility corridor/avenue of approach. The consideration should include such factors as:

- Terrain elevations
- Tree and vegetation height
- Height of built-up areas
- Density of ground vegetation
- Effects of weather

The LOS analysis will provide another means of comparison of the advantages and disadvantages of particular avenues of approach.

f. Analysis of avenues of approach. The final step of the terrain analysis is the selection of the avenue of approach which best supports the move, shoot, and communicate requirements of the force. Each avenue is analyzed with respect to the friendly or enemy capabilities. Advantages and disadvantages are listed and weighed, and a final selection or recommendation is made. For friendly forces this will be the avenue which best accomodates course of action selection and mission accomplishment. In the case of enemy forces this will be the avenue that best supports the most probable enemy course of action.

2.3.2 Weather Analysis

The effects of weather on tactical operations cannot be neglected since weather has an impact on both friendly and enemy operations. Weather can have a tremendous impact on the terrain and must be integrated with the terrain analysis. The weather analysis examines in detail how weather affects friendly capabilities to move, shoot, and communicate and how it is expected to affect enemy capabilities. The military aspects of weather which must be considered in the analysis are visibility, clouds, temperature, precipitation, wind, humidity, and light conditions.

The weather analysis process is diagrammed in Figure 5 and is discussed below.

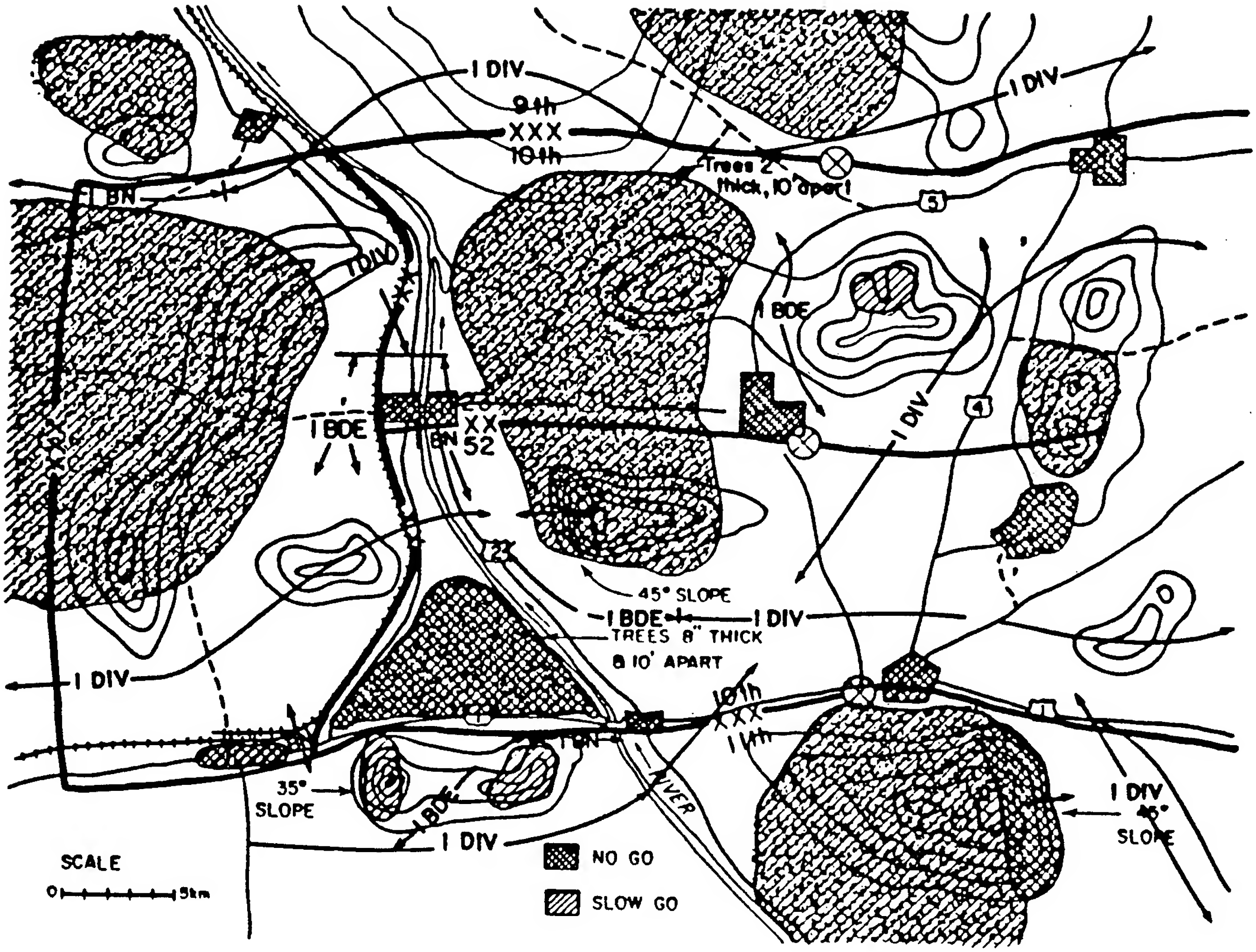


Figure 5. MOBILITY CORRIDORS

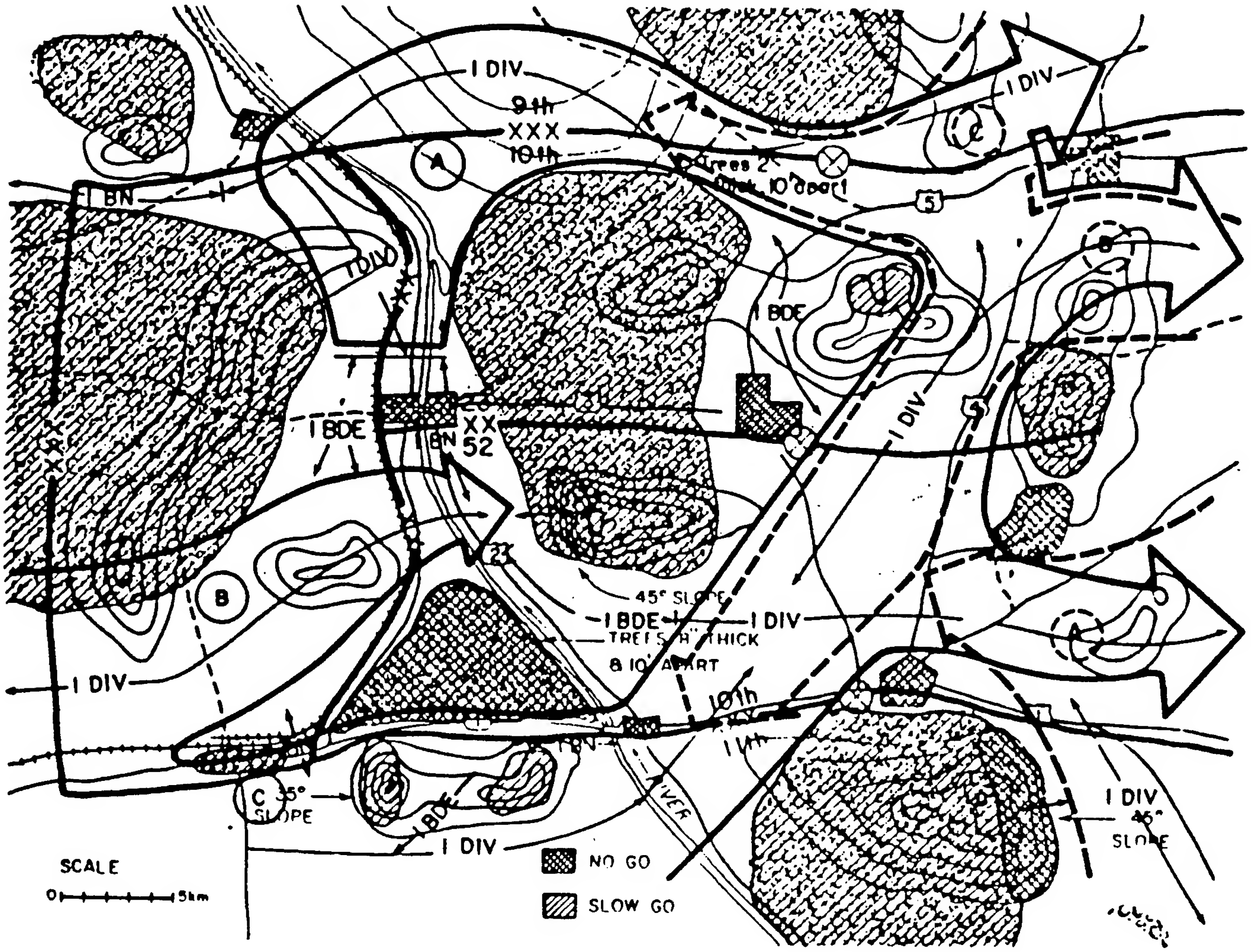


Figure 6. DIVISION AVENUES OF APPROACH

a. Development of the weather factor analysis matrix. Weather analysis begins with the development of the weather factor analysis matrix. This matrix helps to organize the analysis task, define specific weather data requirements, and determine what weather factor overlays will be required. The matrix isolates those weather factors that are militarily significant and correlates their effects with specific combat operations and supporting functions. A typical weather factor analysis matrix is shown at Figure 7.

b. Development of weather factor overlays. As in terrain analysis, maximum use of graphic displays is made to analyze the effects of weather on combat operations. Through weather factor overlays, weather data are converted into graphic displays. Overlays are particularly convenient for integrating weather effects with the terrain analysis. Time permitting, weather factor overlays will be prepared for:

- Fog

- Cloud coverage

- Precipitation effects (rain or snow) on;

    - Hydrography and wet areas
    - LOC's
    - Built-up areas
    - Slopes

c. Impact of weather on terrain. A judgmental, experienced-based determination of the impact of weather on terrain is made by the intelligence officer and is input to the terrain analysis. Weather impact on terrain is primarily on the military aspects of terrain as follows:

- Observation and fire, primarily visibility as reduced by weather such as fog, rain, snow, etc.

- Cover and concealment, primarily the concealment offered by fog, precipitation, cloud cover, and smoke.

- Obstacles, generally those resulting from precipitation or influenced by temperature.

- Key terrain, primarily the modification of the criticality of terrain due to present weather conditions.

- Avenues of approach, primarily in terms of limitations or enhancements in the cross-country mobility, generation or enhancement of obstacles, and general impacts on force movement capabilities.

d. Impact of weather on operations. Having determined the impact of weather on terrain the intelligence officer then extends his analysis to determine the impact of weather, existing and forecasted, upon tactical operations. The impact on operations will consider both the type of operation (e.g., offense, defense, retrograde) and the various elements involved in the operation (combat, combat support, and combat

Intelligence Uses/ Applications	Factors										
	Temperature (1)	Humidity (1)	Intervisibility	Surface winds	Precipitation	Snow/Ice cover	Winds aloft	Cloud data	Light data	Severe weather	Fog
Observation & fields of fire			X	X	X	X		X	X	X	X
Artillery emplacements	X			X	X					X	
Concealment			X	X	X	X		X	X	X	X
Camouflage	X	X	X	X	X	X		X		X	X
Ground avenues of approach	X		X		X	X				X	X
Cross-country movement	X		X	X	X	X			X	X	
Fording sites	X		X	X	X	X			X	X	X
Air drop zones	X		X	X	X	X	X	X	X	X	X
Helicopter LZ	X	X	X	X	X	X	X	X	X	X	X
LOCs and MSRs	X		X		X	X			X	X	
NBC operations	X	X			X	X	X	X		X	X
Line-of-sight radio radar				X	X					X	
REMS emplacement	X			X	X	X				X	
Infiltration routes			X		X	X			X	X	X

(1) Density altitude quality affects helicopter lift capability.

Figure 7. WEATHER FACTOR ANALYSIS MATRIX

service support). The impact will apply to both friendly and enemy operations and will be the precursor to determining the impact of weather on friendly and enemy courses of action.

The impact analysis is essentially judgmental, based on personal knowledge and experience of the staff and upon climatic and topographical studies of the area of operations.

e. Impact of weather on courses of action. The analysis of the impact of weather on terrain and operations leads ultimately to an analysis of the weather impact on courses of action open to each side. The courses of action considered should be as specific as possible and deal with specific forces, specific terrain, and specific types of operations. The courses of action analyzed must be within the force capabilities, mission related, and viable within the operational facts as known at the time. The analysis is judgmental, and a final conclusion is made as to whether weather favors, or is unfavorable to, each considered course of action, friendly or enemy.

2.4 DEVELOPMENT OF ENEMY CAPABILITIES

Enemy capabilities are courses of action which the enemy can adopt and which will influence the accomplishment of the friendly mission, either favorably or unfavorably. A complete statement of a capability will include what the enemy can do, when he can do it, where he can do it, and in what strength he can do it. The evidence considered in the analysis and discussion of enemy capabilities includes characteristics of the area of operations and positive or negative evidence of enemy presence or activities. In analyzing and discussing the enemy capabilities the intelligence officer must judge from an enemy point of view the advantages and disadvantages of adopting each capability. He must consider enemy doctrine and past practices as well as the ultimate results of adoption or rejection of a particular capability. Actions which are grossly disadvantageous to the enemy, or are unreasonable, are not included. Further, if there is no indication of the enemy's adoption of a particular capability and it does not represent a major threat to the accomplishment of a friendly capability, then it should not be considered.

The following considerations apply to the development of enemy course of action or capability statements.

2.4.1 What the enemy can do. Four types of tactical capabilities are usually possible: attack, defend, retrograde, or reinforce. These operations are usually divisible into a variety of more specific actions. For example, an attack may be a penetration, an envelopment, a turning movement, or a pursuit. A defense may be in a single position or successive positions, static or mobile. A retrograde may be classified as a withdrawal, retirement, or delaying action. The specific actions which the enemy can physically adopt depend on the available means and the conditions under which those means can be used. Consequently, the "what" of each of the enemy's capabilities is determined by the characteristics of the area of operations, the order of battle of the opposing forces, and time and space factors. Characteristics of the area of operations, friendly situation, and the means available to the enemy will usually indicate that he is capable of some actions and incapable of others.

2.4.2 When the enemy can do it. The time required for the enemy to employ his combat power capabilities depends on the disposition of his forces and equipment. An enemy capability involving the displacement of forces cannot be put into effect until some time after the force has begun to move. Reserves cannot reinforce an attack or defense until they have been moved to appropriate locations such as attack positions or forward assembly areas. Consequently, time and space factors are computed in determining the "when" of a capability involving displacement of forces or equipment.

2.4.3 Where the enemy can do it. The "where" of an enemy capability depends on the weather, terrain, and disposition of his forces. Under existing or predictable conditions of weather, the terrain may provide avenues of approach into friendly positions from the flank, front, or rear. Conversely, it may prevent the enemy's use of armored, mechanized, or airborne forces in certain areas. Cross compartments may provide the enemy with suitable defense or delaying positions. The existence of suitable objectives, drop, or landing zones indicates where airborne forces may be employed. The presence of suitable beaches suggests where enemy amphibious forces may be used. The location of adequate assembly areas and attack positions indicate where enemy missile launchers may be located. Accordingly, the intelligence officer determines the "where" of each enemy capability through analysis and integration of the characteristics of the area of operations with the situations of the opposing forces.

2.4.4 In what strength can he do it. The strength the enemy can use in any particular capability depends primarily on the composition, disposition, and strength fo the available forces. Order of battle intelligence furnishes the necessary information. The estimate of enemy strength is usually limited to close combat units such as infantry, armor, and mechanized (including reconnaissance) units and their combat support means such as artillery, air, chemical, and nuclear weapons.

2.4.5 IPB. In terms of the IPB process, the development of enemy capabilities includes both the threat evaluation and threat integration steps of that process.

Threat evaluation is the detailed analysis of the enemy; his tactical doctrine, weapons and equipment, organization, composition, and support functions. Threat forces are identified, and a detailed order of battle (OB) is constructed. The objective of this step is to determine how the enemy can be expected to operate and what his capabilities are, doctrinally. The doctrinal template is the primary tool used in this step.

Threat integration is the heart of the entire IPB process. It is the integration of the enemy forces and their doctrine with the terrain and weather to determine what actual capabilities (potential courses of action) are available to the enemy in this area at this time. Threat integration is a sequential process in which the G2 develops situation, event, and decision support templates.

The situation template depicts how the enemy might deploy and operate within the constraints imposed by the current weather and terrain and force status. This template is used to identify critical enemy activities and locations. It provides the basis for high value target (HVT) analysis and target

development.

The event template shows where critical events and activities are expected to occur and where critical targets may appear. It is used to predict time-related events throughout the area. The event template provides the basis for collection planning, prediction of enemy intentions, and for acquiring and tracking HVTs.

The decision support template relates the significant events depicted by the event template to identified target areas by depicting the relative point in time that a tactical decision is required to take advantage of or exploit the situation. The decision support template is a major product of the G2 IPB process and is a graphic representation of the intelligence estimate.

2.5 EFFECT OF AREA OF OPERATIONS AND ENEMY CAPABILITIES ON MISSION ACCOMPLISHMENT

Friendly courses of action are developed by the G3 and furnished to other coordinating staff members to facilitate their planning efforts. The intelligence officer, using all the information and analyses from the previously discussed intelligence functions, must draw conclusions as to the effect that the area and the enemy will have on each considered friendly course of action.

Using the analysis of the area of operations, the intelligence officer states the total effects of weather and terrain on mission accomplishment. He identifies the obstacles and key terrain and presents the avenues of approach to the G3 and commander. From the identification and analysis of the enemy capabilities the intelligence officer evaluates the effect that each enemy capability is expected to have on each friendly course of action. He specifically identifies each enemy capability that, if adopted, would have an adverse effect on friendly mission accomplishment.

2.6 PROBABLE ENEMY COURSES OF ACTION

Relative probability of adoption of each feasible enemy capability or course of action is determined based on the enemy doctrine, terrain and weather, relative combat power, and recent enemy activities. The intelligence officer makes this determination by evaluating each capability from the enemy's perspective and judging the advantages gained for the enemy by each. His conclusions are presented to the commander and the G3 for their consideration in choosing the friendly course of action.

2.7 MONITORING AND ALERTING ENEMY OPERATIONS

The intelligence officer must continuously monitor enemy operations and activities and update his estimate throughout any tactical operation. He must be especially alert to both anticipated and unanticipated enemy actions to insure that deviations from the expected course of action are detected early. The IPB event template provides the G2 an invaluable aid in this process.

The event template depicts named areas of interest (NAI) along each mobility corridor and the relationship of events along mobility corridors. NAI are points or areas where enemy activity or lack of activity will confirm

or deny the adoption of a particular course of action by the enemy. An example of the event template is shown in Figure 8. The event template is used to predict time-related events throughout the area. By knowing what the enemy is capable of doing and comparing this to what he is actually doing, future enemy activities can be reasonably projected. The event template is useful for:

- Collection planning, by providing high priority focal points for collection assets and providing a basis by which the intelligence officer may assign information threshholds which provide alerts that a particular action is confirmed or not within a time limit or by specified activities;

- Prediction of enemy intentions, by providing for the comparison of activities within and between mobilty corridors with those that must occur for particular courses of action;

- Acquiring and tracking high value targets (HVTs), by detailing where and when to look for these targets.

The event template also provides a basis for the decision support template (see example at Figure 9.) The decision support template relates the details of the event template to points in space and time where tactical decisions may be required to effect battlefield events. The decision support template does not dictate decisions to the commander but rather identifies critical tactical events and threat activities relative to time and location which may require tactical decisions by the commander. The decision support template provides a structured basis for using judgment and experience to reduce battlefield uncertainties.

2.8 REPLANNING

The monitoring and alerting of enemy operations will frequently detect variations from the expected activities. These variations may be the result of minor or extreme deviations from the expected enemy course of action. The intelligence staff officer must evaluate each of these occurrences and modify his estimate of the situation accordingly.

When replanning becomes necessary, the G2 may re-enter the normative course of staff actions at any point. Replanning, particularly during the heat of battle, is extremely time critical. The intelligence officer must make very rapid evaluations of new information and incorporate his judgment of that information into his estimate of the situation. The replanning may require only minor adjustments to the situation or may require that an entirely new estimate of enemy capabilities and courses of action be completed. Modifications, either large or small, must be communicated to all affected staff members and are of particular importance to the G3 and commander.

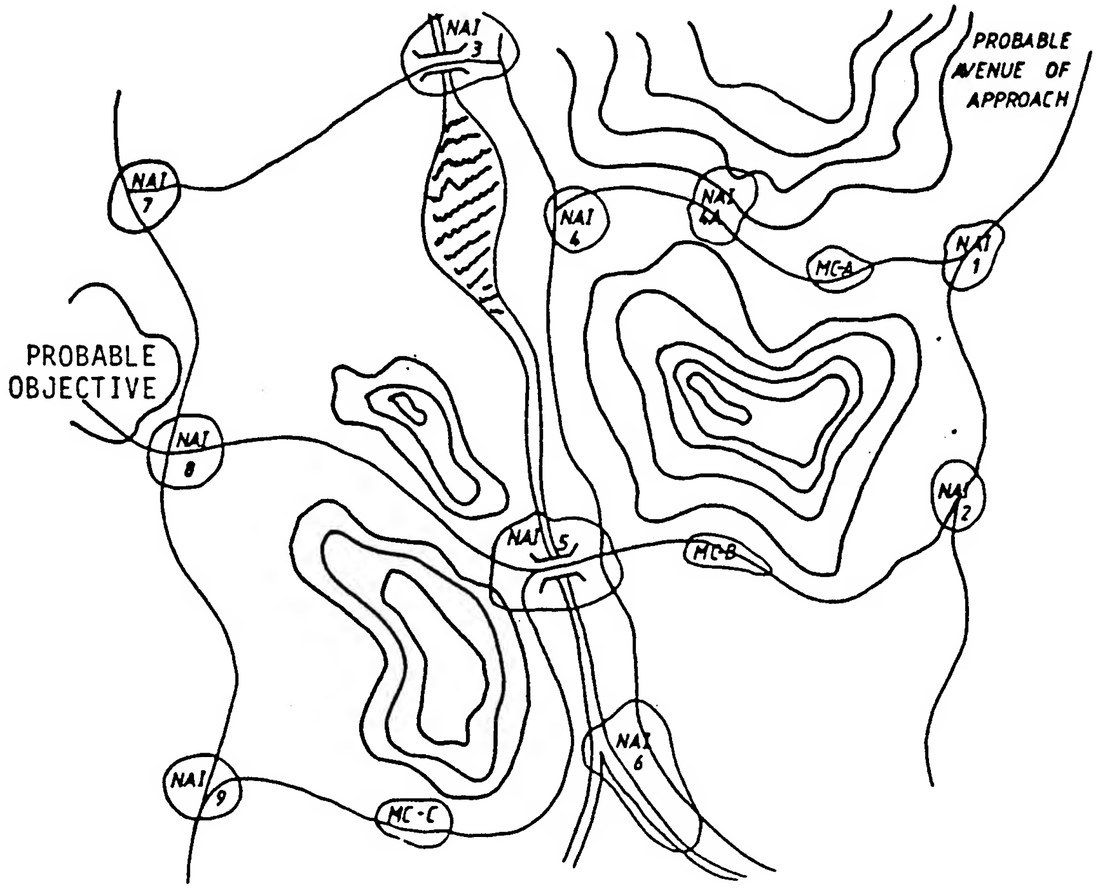
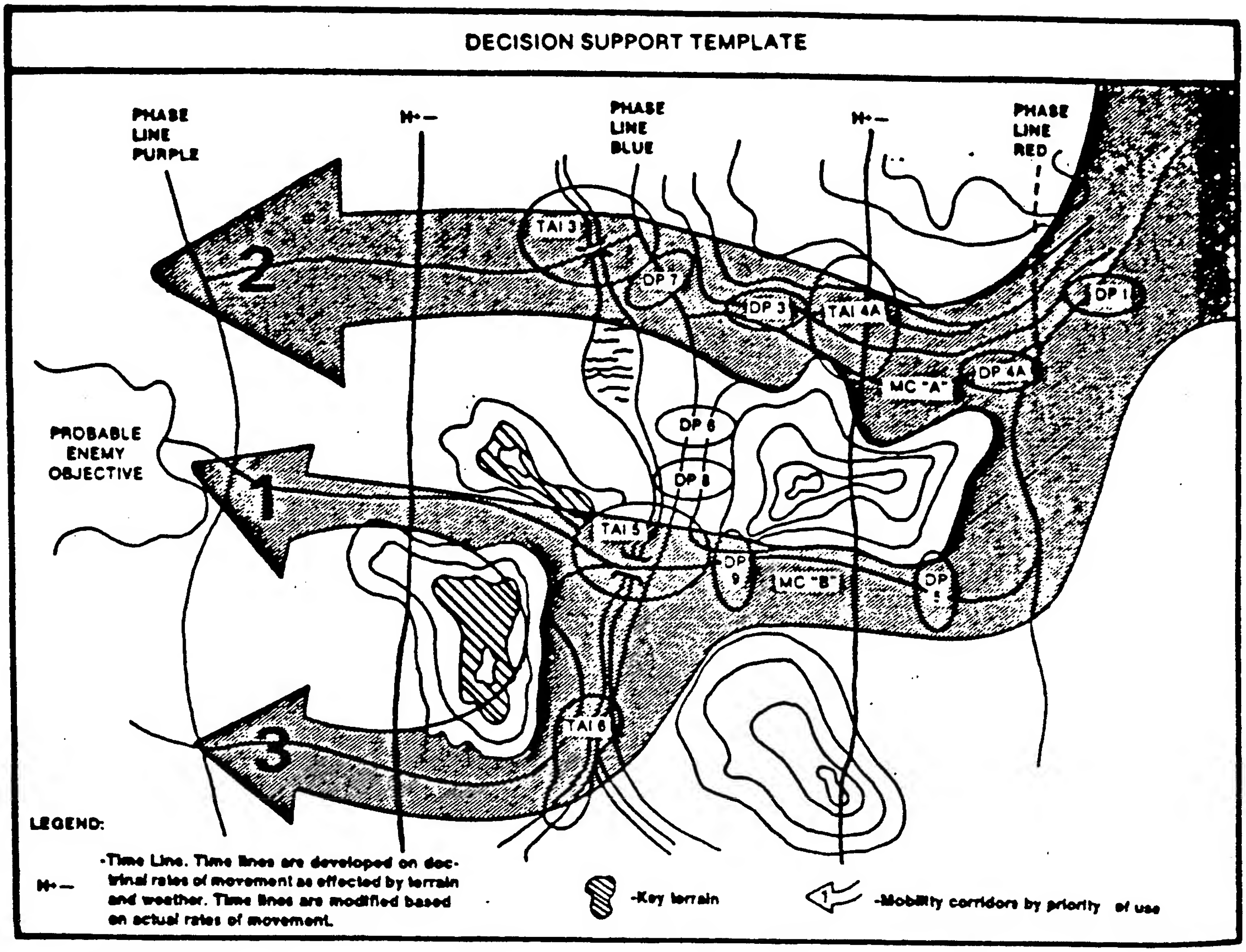


Figure 8. SAMPLE EVENT TEMPLATE



TAI - target area of interest
DP - decision point
MC - mobi-lity corridor

NAI - named area of interest

Figure 9. SAMPLE DECISION SUPPORT TEMPLATE

OPERATIONS STAFF FUNCTION

1.0 INTRODUCTION

The operations officer (G3) is the principal coordinating staff officer for the commander in matters relating to operations, plans, organization, and training. The nature of the operations officer's responsibilities requires a high degree of coordination with other staff members, and generally the G3 takes the lead among all of the staff members, excluding the chief of staff.

The normative courses of staff action addressed herein will cover primarily the tactical operations responsibilities and actions, the more important of which are:

- Collecting and assimilating information relating to the tactical operations of the command.
- Maintaining a current operations estimate of the situation.
- Preparing operation plans and orders.
- Recommending priorities for the allocation of critical resources of the command.
- Recommending task organization and assigning missions to subordinate elements of the command.
- Using resources to accomplish both maneuver and fire support.
- Coordinating and integrating all aspects of maneuver and fire support.
- Monitoring tactical operations and adjusting plans and actions as necessary.

2.0 STAFF ACTIONS

The significant operations staff functions relating to combat operations are displayed in Figure 1 and are discussed in the following subparagraphs.

2.1 MISSION ANALYSIS

A mission for tactical operations may be received in the form of an operation order from higher headquarters or may be generated by the force commander based upon his perception of the tactical operation already in progress. In either case, the coordinating staff principals meet to receive from the commander the mission plus all other information which the commander has at the time and which has not been announced in the order. This other information may include an explanation of the higher commander's intent and guidance,

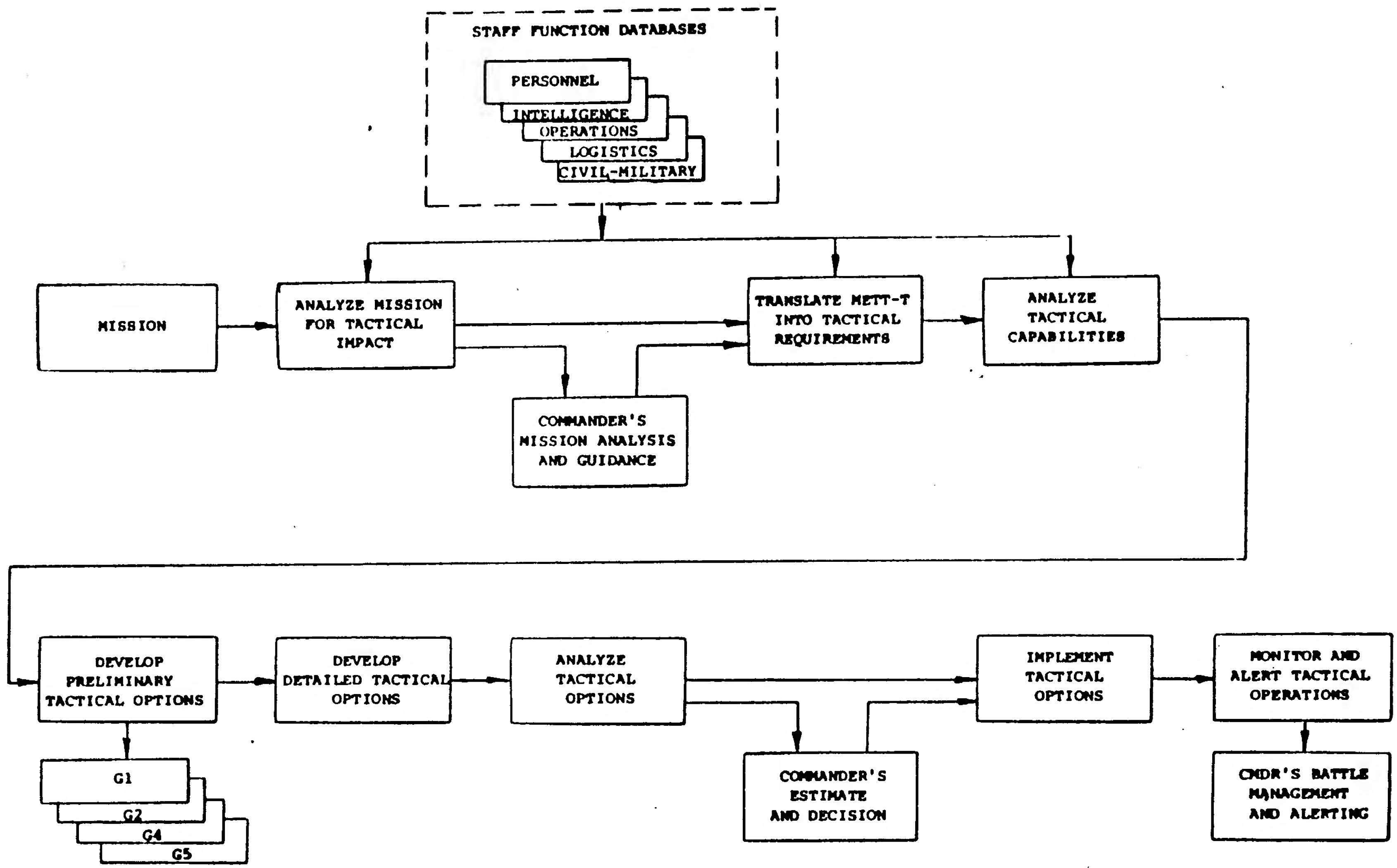


FIGURE 1. Operations Staff Functions

insights, concerns, and anticipated actions and perceived options. This information assists the staff in better grasping the tasks of the mission and the requirements that will fall upon each coordinating staff section. All staff members continue situation updates with emphasis focused on the new mission and simultaneously begin mission analysis in their respective areas of responsibility. It is imperative that each principal staff officer understand what is essential to the commander and the other principal staff officers. Once what is essential is known, the principal staff member has his staff section focus on that information and keep him apprised of changes so he can evaluate their impact and advise the commander and the rest of the staff.

Mission analysis identifies and quickly analyzes the following:

- Purpose of the higher headquarters mission.

- Intent of the higher commander and possibly the commander two levels up.

- Area of operations.

- Tasks, both specified and implied, to be performed.

- Assets available.

- Constraints.

- Restraints.

- Risk acceptable to higher headquarters.

- Time analysis.

(Note: The general mission analysis explained above is applicable to all coordinating staff sections.)

The operations officer focuses his mission analysis on the tactical performance of the assigned mission, and he generally takes the lead among the coordinating staff principals in overall mission analysis. Immediately upon receipt of the mission from the commander, the operations officer develops tentative tactical courses of action which will accomplish the mission, and he informs all other coordinating staff principals of those tentative courses of action. These tentative courses of action serve to focus and integrate the mission analysis and mission planning of all coordinating staff principals. The operations officer will refine and update the tactical courses of action as planning proceeds.

In the tactical mission analysis, the operations officer interprets the assigned mission for operational/tactical tasks, explicit and implied. He relates the mission to the area of operations and determines the area required to accomplish the mission. He then reviews the current task organization; analyzes the status of forces and resources of the command; identifies tactical constraints and restraints; assesses tactical risks inherent to mission performance; analyzes time available for planning; and recommends to the commander tactical courses of action for mission performance. The operations

officer's recommendations consider major factors provided by other coordinating staff members which may significantly impact mission performance. Recommendations evolving from the operations officer's mission analysis generally carry considerable weight in the formulation of the commander's planning guidance.

2.2 IDENTIFICATION OF TACTICAL REQUIREMENTS

Following the commander's mission analysis and issuance of the commander's planning guidance, the operations officer considers tactical courses of action which the commander wishes developed, which may or may not include those considered by the G3 in his mission analysis. The commander's guidance forms the latitude which the G3 has to develop courses of action. The G3 collects additional information not already available and proceeds with his estimate of the situation.

An analysis of the mission, enemy, terrain (and weather), own troops, and time available (METT-T) is performed in order to identify the requirements for mission accomplishment. The G3 translates the mission into more specific terms; considers the enemy strength, dispositions, equipment, doctrine, capabilities, and probable intentions; analyzes the terrain for observation and fires, cover and concealment, obstacles, key terrain, and avenues of approach; assesses the impact of weather and visibility conditions on the terrain and upon mission accomplishment; considers the friendly forces necessary for mission performance; and analyzes the time available for both staff planning and unit preparation as well as time for mission performance.

2.3 ANALYSIS OF TACTICAL CAPABILITIES

The G3 next garners all facts about the status of friendly forces and resources available for mission performance. He considers the current task organization; current unit status, locations, capabilities, and current and recent activities; the non-organic combat support available; and information of higher, adjacent, and other supporting units. He gathers and analyzes all information which will give him a clear picture of the unit's combat power and capability to perform the assigned mission.

It is especially important that the G3 have available to him current unit status including all information which will accurately portray the real-time readiness of each constituent unit to perform its mission role. Such a requirement demands that the database of force information be the most current possible.

2.4 DEVELOPMENT OF PRELIMINARY TACTICAL OPTIONS

In order to obtain the maximum synergistic effect from coordinating (general) staff planning, the entire staff must have access to preliminary tactical options being considered by the commander and the operations officer. Acting upon the commander's guidance and constraints on courses of action selection, the G3 prepares early in the planning cycle the preliminary tactical options. At corps and division level these preliminary courses of action will generally be limited to two or three so as not to dissipate unnecessarily the staff planning resources and time. If possible, the G3 may indicate which of the courses of action is most probable of adoption,

depending, of course, on the outcome of staff estimates and recommendations of all coordinating staff principals. Experience and judgment, knowledge of the commander's style in decisionmaking, and general force status information support the G3 in this preliminary course of action identification.

2.5 DEVELOPMENT OF DETAILED TACTICAL OPTIONS

The G3 next embarks on the preparation of his operations staff estimate which will lead to his recommendation to the commander of a tactical course of action which has the highest probability of mission accomplishment. In preparing the operations estimate, the G3 considers all elements and aspects of the situation that influence tactical operations and mission performance, and he formulates tactical options or courses of action. He carefully screens situational information to determine those facts that will influence friendly and enemy actions and will, therefore, influence the choice of a specific course of action. Situational information includes characteristics of the area of operations, the enemy situation, the situation regarding his own forces and resources, and the relative combat power between friendly and enemy forces. Situational information is derived from the force database and from other coordinating staff officers.

The G3's analysis of relative combat power is based primarily on maneuver and fire support units of the force. His analysis is expected to provide a background for formulating feasible tactical courses of action and may indicate the basic nature and characteristics of those courses of action. The G3's conclusions regarding relative combat power may also lead to the early elimination from consideration of some courses of action as being infeasible of mission accomplishment.

Relative combat power is the overall relationship of the combat power of friendly versus enemy forces including significant strengths and vulnerabilities. Analyzing relative combat power permits conclusions about friendly capabilities pertaining to the operation being planned. It indicates what types of operations may be possible from the enemy as well as the friendly points of view. It also helps to determine enemy weaknesses.

At division level, G3 avoids making a detailed study of personnel or weapons on either side. To gain an indication of the fighting capabilities of friendly and enemy units, the G3 deals in rough ratios two levels down. At division level, the analysis compares all types of combat battalions. Conclusions are based on a general impression of the capabilities of both forces. The planner, first, establishes comparison values as a means of quantifying forces. A simple comparison of the number of battalions would be inappropriate since the capabilities of different units vary; therefore, the G3 must determine the overall combat value of the type units being compared. To accomplish this, a base unit must be selected. A subjective evaluation must then be made of all other types of battalion-size units relative to the base unit. These values can be listed in a table of relative comparison values and used repeatedly. Table 1 is an example of such a table.

TABLE 1. US vs Soviet Combat Unit Comparison Values (Base unit is BTR battalion)

MANEUVER

US (J-Series)		Soviet	
M113 Bn	= 1.5	BTR Bn	=1
M2 Bn	= 2	BMP Bn	= 1.5
M60 Bn	= 2.75	Tk Bn (ITR)	= 2.6
M1 Bn	= 3	Tk Bn (TR)	= 1.6
ACR Sqdn	= 2.75	AT Bn	= 1
Div Cav Sqdn (H)	= 2	ITB/TB (MRR)	= 2.0
Div Cav Sqdn	= 1.5		
Atk Hel Bn	= 4	Atk Hel Bn	= 2

ARTILLERY

FA Bn	= 2	FA Bn	= 2
MLRS Btry	= 2	MRL Btry	= 1

When unit comparison values have been established, the G3 then computes the relative combat power of the opposing forces and evaluates the results. At this point, the G3 can draw some reasonable conclusions about his and the enemy's capabilities and limitations in the conduct of either offensive or defensive operations in the present tactical situation.

Having established relative combat power between opposing forces, the G3 then turns his attention to possible friendly courses of action. Applying current tactical doctrine and his own personal experience, he visualizes alternative courses of action which will achieve the force objective under the existing conditions. The ability to formulate courses of action quickly and accurately is essential to sound decisionmaking. The formulation and recognition of feasible courses of action depend significantly on the G3's ability to perceive the influence of the situational factors on mission performance, and that perception must consider the following:

- Is the course of action feasible?
- Does the force have the capability to perform the course of action?
- Will the course of action accomplish the mission without undue risk of damage to the force?

- Are the courses of action in sufficient detail to be distinguishable one from the other?

In order to verify the feasibility of tactical courses of action, the G3 may often resort to doctrinal templates, which are used in much the same manner as the G2 uses doctrinal/situational templates to identify enemy courses of action and capabilities. Beginning with combined obstacle overlays of the area of operations, the G3 will array situational templates for friendly forces on terrain representations to assist in identifying mobility corridors and avenues of approach. For offensive missions, the G3 will seek avenues of approach to force objectives, avenues which will accommodate one or more major subordinate elements of the force. For defensive missions, the G3 will be sensitive to enemy avenues of approach into friendly positions to the end of positioning friendly forces and resources to block those avenues.

The G3 will next array the friendly force for each course of action being considered as feasible for mission accomplishment. In arraying the force, the G3 will consider the mission and the commander's guidance, the avenues of approach, and the most likely and most dangerous enemy courses of action. The organizational level of the planning will most often determine the level of the units to be arrayed; for example, at division level, battalions are arrayed along brigade-size avenues of approach, while at corps level, brigades are arrayed along division-size avenues of approach.

G3's next consideration in arraying forces is to achieve force ratios between friendly and enemy forces which will reasonably ensure mission success. Mission-related planning ratios for the array of friendly forces should achieve the following minimum:

Friendly Mission	Friendly: Enemy	Notes
Delay	1:6	
Defend	1:3	Prepared or Fortified
Defend	1:2.5	Hasty
Attack	3:1	Prepared or Fortified
Attack	2.5:1	Hasty position
Counterattack	1:1	Flank

For each force array, the G3 will develop a scheme of maneuver, the means for actually achieving the force mission. The scheme of maneuver and the arrayed combat power, friendly and enemy, will be the basis for analysis of each course of action. The scheme of maneuver development will address:

- The enemy and terrain.
- The relative combat power and acceptance of risk.
- Uncommitted friendly forces and resources.

- Type of operation (mission).

- Objectives (attack or counterattack).

- Location of main effort and supporting efforts.

For each course of action, the G3 will next determine command and control means and maneuver control measures. Determining the command and control means involves the assignment of control headquarters for the arrayed forces. Determination of maneuver control measures involves the establishment of such measures as boundaries, axes of advance, objectives, phase lines, lines of departure, and assembly areas.

Having accomplished the foregoing, course of action statements are then developed for each feasible course of action and must include the following essential elements:

- The type of tactical operation (what).

- The time the operation must begin or end (when).

- The location or direction of the operation (where).

- The use of available means for the operation (how).

- The purpose of the operation (why).

Developed courses of action are now ready for analysis and the selection of that course of action which offers the best opportunity for mission success.

2.6 ANALYSIS OF COURSES OF ACTION

The G3 analyzes (war games) each course of action against the likely enemy course(s) of action starting with the most probable enemy course of action. War gaming relies heavily on tactical judgment and experience but is a logical step-by-step analytical process. It focuses the G3's attention on each phase of the operation in a logical sequence. The process is one of action-reaction-counteraction.

War gaming stimulates thought about the operation so the G3 may obtain ideas and insights that otherwise might not have occurred. Analysis highlights tasks that appear to be particularly important to the operation and provides a degree of familiarity with tactical possibilities that might otherwise be difficult to achieve. During the war game, the course of action may be changed or modified or a new one may be developed because of the identification of other critical events, tasks, requirements, or problems. As a result, the analyst or war gamer can determine whether the force allocation (including combat support and combat service support assets), dispositions, and scheme of maneuver are adequate, or he can correct and adjust as appropriate. Shortfalls, acceptable or unacceptable risks, and possible future developments, options, and contingencies are identified for the plan or order.

Logical steps used by the G3 in analyzing (war gaming) each course of action are:

- Post the map and array the enemy force from the intelligence known.
- Array the friendly forces for the course of action under analysis.
- List all friendly forces.
- List assumptions.
- List known critical events.
- Select an analysis (war game) method.
- Select a technique to record and display results.
- Visualize the battle and assess the results.

Results of each course of action are analyzed for refinements and modifications which would improve the course of action; tasks for subordinate units; estimate of battle duration; advantages and disadvantages; deduced battle results (ground gained/lost and number of enemy defeated); requirements for additional combat support; and requirements for surprise and/or deception. Special attention in analyzing each course of action will be paid to significant risks which might be encountered in executing the course of action.

Once analyzed, the feasible courses of action are compared to identify the one which has the highest probability of success against the most likely or dangerous enemy course of action yet offers the flexibility of facilitating success against other likely enemy courses of action. The comparison will support a G3 recommendation to the commander of the best course of action for mission accomplishment.

2.7 IMPLEMENTATION OF TACTICAL OPTIONS

Decisions made by the commander based upon staff recommendations and his own estimate of the situation are translated into orders and instructions to subordinate commands and are disseminated in a variety of forms. The most dominant form is the operation order prepared by the G3 and includes annexes prepared by other staff sections. From an operations standpoint, the operation order translates the selected course of action, its development, and its analysis into clearly stated instructions for mission performance by all force elements. The G3 is particularly interested in the mission performance by combat and combat support elements of the command; therefore, he ensures by personal contact and other means that the commander's intent is clear and that the instructions for mission performance are fully understood.

2.8 MONITORING AND ALERTING TACTICAL OPERATIONS

The G3 monitors the implementation of the operation order by all combat and combat support elements of the command. In so doing, he ensures that critical events in the battle performance are quickly and accurately reported to him for action and for alerting the commander. Opportunities for command decisions at critical points in the battle are immediately recognized from these alerts. Monitoring and alerting are discussed in the following subparagraphs.

2.8 1 Monitoring Tactical Operations

In monitoring tactical operations, the G3 ensures that mission performance is proceeding according to plan. If not, the G3 must take actions within his authority to rectify the situation or, alternatively, refer the matter to the commander for information and/or decision.

Monitoring of the tactical situation is significantly dependent upon the receipt, display, and assimilation of complete and accurate information relating to mission performance. In order to properly perform his operation monitoring function, the G3 selects critical items of information which must be presented to him with the frequency and in the format which will facilitate his accurate perception of the situation; his rapid analysis of the situation in relationship to the plan; his ready identification of alternative forces, resources, and actions to rectify an undesirable situation; and his evaluation of those alternatives. The information required by the G3 is not that associated solely with the operations staff function but will normally include other information impacting mission performance. The information may include reports of heavy casualties, significantly reduced unit strengths, and difficulties in medical evacuation from the G1; actions indicating adoption of new enemy courses of action from the G2; shortages of POL, ammunition, and key equipment items from the G4; and refugee problems from the G5, all of which may significantly impact tactical operations. Immediate identification and analysis of problem areas is essential, alternatives for their solution must be quckly analyzed, and tactical decisions must be made efficiently and effectively to deal with the problems.

In order to perform his monitoring function, the G3 must be supported by a system, manual or automated, which will accommodate his information and analysis requirements.

2.8.2 Alerting For Tactical Operations

In the planning for tactical operations, the G3 will identify critical events in the battle plan which serve as check points as to whether the operation is proceeding according to plan. Significant deviations from plan may require modifications to plan or actions to ensure that the plan can be executed as devised. Critical events may also signal potential problems which, if realized, may inhibit or prevent mission accomplishment. Critical events may take the form of positive action or, conversely, the lack of action.

A system for alerting the G3, operated manually or automatically, monitors inputs and updates to the force database in order to alert the G3 and the commander of tactically significant changes. Tactically significant changes may be those established by tactical standing operating procedures (e.g., crossing phaselines or seizing intermediate objectives) or may be those established specifically for the operation at hand (e.g., when the 1st Brigade has crossed the YODER River). Absence of information concerning a critical event may indicate that the event has not taken place or that the occcurrence of the event has not yet been reported. If critical to operational performance, lack of reports of the occurrence of critical events must be verified by positive action on the part of the concerned staff section or the information collection system.

Alerts to the G3 should originate, if appropriate, from all coordinating staff principals and their staff sections. Some examples of alerts from the coordinating staff sections at division level are:

G1

- Maneuver battalion strengths drop below 75%.
- Casualties exceed 20 per hour (or 10% per day).
- Key commander casualties.

G2

- Enemy second echelon (reserve) motorized rifle regiment is moving forward.
- Enemy direct support artillery has been positioned within 2 km of the FLOT.
- Enemy has imposed radio silence.
- Enemy is jamming all radio transmissions.

G3

- 3d Bde has crossed PL Charlie.
- 2d Bde has committed its reserve.
- Armored cavalry squadron has encountered estimated enemy tank regiment.

G4

- No diesel fuel at Corps Class III Sup Pt due to enemy action; supply limited to one day supply on hand.
- 105 mm tank ammo CSR reduced to 50% of RSR.
- Float of M1 tanks has been reduced to zero.
- CSR on 155 mm howitzer ammo has been lifted.

G5

- Refugees are completely blocking MSR Blue and are uncooperative.

2.9 REPLANNING

The monitoring and alerting of tactical operations by the G3 will frequently result in modification to the original battle plan. The modifications may range from minor changes in order to fine-tune the original plan or may involve major changes to the plan due to such significant events as changes in the enemy courses of action, unexpected losses by friendly forces, more severe weather impact on operations than anticipated, and unusual resource (ammo or POL) expenditures and/or constraints on operations.

When replanning by the G3 becomes necessary, the G3 may re-enter the norma-

tive course of staff actions at any point in the cycle. He may simply modify (with the commander's explicit or implicit approval) an order to a subordinate unit; or he may re-estimate the entire situation, consider new courses of action, analyze them, and make a new recommendation to the commander for the continuation of the tactical operation. Replanning of tactical operations, once the battle has been joined and is in progress, is accompanied by the stress element of time. Opportunities to take advantage of the tactical situation are fleeting; therefore, in replanning, the G3 normally does only the minimum replanning necessary to take advantage of the situation and the opportunity.

3.0 OTHER CONSIDERATIONS

A number of other planning considerations are inherent to tactical decisionmaking and to the application of the normative courses of staff action discussed above. The purpose of presenting other considerations is to indicate wherein the G3 may broaden the scope of the normative courses of staff action as well as rely upon others to perform detailed planning under staff supervision of the G3. Other considerstions are presented in the following subparagraphs.

In the application of the normative courses of staff action, the G3 focuses his attention on close operations and probably devotes a majority of his planning and monitoring activities to that operational environment. He cannot, however, overlook the requirement to also plan and monitor deep and rear operations which are inherent to tactical mission performance. Close operations bear the ultimate burden of victory or defeat; however, both deep and rear operations will have an ultimate impact on mission performance.

Close operations comprise the current activities of major committed combat elements, together with their immediate combat support and combat service support. At the operational level, close operations comprise the efforts of large tactical formations -- corps and divisions -- to win current battles. At the tactical level, close operations comprise the efforts of smaller tactical units to win current engagements. Among the activities typically comprising close operations are:

- o Maneuver
- o Close combat (including close air support).
- o Indirect fire support (including counterfire).
- o Combat support/combat service support of committed units.
- o Command and control.

Deep operations comprise activities directed against enemy forces not in contact and designed to influence the conditions under which future close operations will be conducted. At the operational level, deep operations include efforts to isolate current battles and to influence where, when, and against whom future battles will be fought. At the tactical level, deep operations are designed to shape the battlefield to assure advantage in subsequent engagements. Of principal concern at the tactical level are

successful efforts to isolate the tactical battlefield; to paralyze the enemy's support and command and control systems; and to prevent, delay, or discupt the closure of uncommitted enemy formations and other resources.

Rear operations comprise activities rearward of elements in contact designed to assure freedom of maneuver and continuity of operations, including continuity of sustainment and command and control. Rear operations underwrite the tempo of combat, assuring the commander the agility to take advantage of any opportunity without hesitation or delay. Four rearward activities in particular must be conducted as part of rear operations: assembly and movement of reserves, redeployment of fire support, maintenance and protection of sustainment effort, and maintenance of command and control.

3.1 SUPPORT OF STAFF ACTIONS

The normative courses of staff action discussed in paragraph 2 above address the principal staff actions of the G3 in tactical decisionmaking in a mid-intensity conventional war (see paragraph 4 below for a discussion of conflict situations). Supporting staff actions by the G3 and his section team not discussed in detail previously are presented in this paragraph and must be considered and/or performed if dictated by the mission, tactical situation, and the operations plan.

3.1.1 Fire Support Planning

Fire support planning starts when the commander receives or assumes a tactical mission, It is an integral part of the commander's planning and decisionmaking process which is a continuous process until the unit's mission is accomplished. The goal of fire support planning is to help integrate fire support with the scheme of maneuver to gain the maximum combat power for the commander. Detailed fire support planning and coordination is normally performed by the unit's fire support coordinator working with the G3 and the G2.

As the G3 prepares his estimate and the battle plan for the employment of maneuver forces, he visualizes how the fire support resources will be used to support the scheme of maneuver, which subordinate echelon will be weighted with fire support, what targets to attack with what fire support means, and priorities for engaging targets and allocating fire units. The G3 ensures that the fire support plan is developed accordingly, that all available fire support is considered,and that the maneuver plan is optimally enhanced by fire support.

3.1.2 Air Defense Planning and Airspace Management

Commanders are responsible for the air defense of the forces assigned or attached to their commands and must always consider the effect of the enemy air threat on their plans and operations. Air defense planning comes under the purview of the G3; however, the detailed planning and execution is the prerogative of the air defense artillery commander.

Army airspace management provides for the coordinated use of division airspace by combat, combat support, and combat service support units. Airspace management ensures the most effective use of airspace for support of

the division's assigned tactical mission. Airspace management comes under the coordinating staff supervision of the G3; however, actual airspace management within the division is performed by the division airspace management element (DAME).

3.1.3 Tactical Nuclear Employment

The normative courses of staff action presented herein have been predicated on a conventional (non-nuclear) warfare environment. Once authority to employ tactical nuclear weapons is granted, the normative courses of staff action will require significant changes to accommodate the planning for and actual employment of such weapons.

The authority to use nuclear weapons will be conveyed from the National Command Authority (NCA) through the operational chain of command. Nuclear fire planning is subject to unique considerations. Far more than conventional fire planning, nuclear fire planning will require a high level of anticipation. Typically, nuclear packages grouping a specified number of weapons having specified delivery system/yield characteristics will be preplanned for use against specified target categories.

Because of this high degree of preplanning, effective weapons employment will require continuous refinement of package targeting before and after release of weapons. Release will be predicated on a high confidence that the effects achieved will be precisely those intended. Commanders of delivery units must ensure that all supporting activities -- target acquisition, special ammunition distribution, nuclear control personnel and equipment, and operational security -- are maintained continuously in a high state of readiness to execute on relatively short notice. This must be accomplished with minimum degradation of conventional fire support and without an abrupt and detectable shift in operating pattern.

Finally, nuclear planning must, of course, reflect the constraints and directives of higher authority to include procedures for warning friendly units, restrictions on collateral damage, and responsibilities for post-strike analysis. Special care must be taken not to create obstacles to friendly maneuver through the use of nuclear fire. Divisions and corps will develop packages for possible use in their areas of operations based on the above criteria and their particular situations.

Nuclear weapon employment, as with conventional fire support planning, is under the coordinating staff supervision of the G3, who will very carefully exercise that supervision. The G3 and the fire support coordinator work closely together to effectively integrate maneuver and fire support (nuclear as well as non-nuclear) into a plan that will successfully accomplish the division mission. The fire support coordinator, however, will do the actual integration of nuclear fires with conventional fires and will perform the detailed target analysis and targeting.

3.1.4 Engineer Operations

Engineer units within the division either support or serve in combined arms teams in all combat operations and in diverse environments. Normally, they support forward, committed maneuver elements, but they can be shifted to

weight the tactical effort at critical times and places. Engineers provide a combat multiplier that reinforces terrain to the advantage of friendly forces or to the disadvantage of enemy forces. The principal battlefield missions for engineer elements are mobility, countermobility, and survivability.

Planning for engineer employment and support within the division is a G3 coordinating staff responsibility; however, much of the detailed planning for engineer operations falls to the division engineer (i.e., the division engineer battalion commander). The division engineer, assisted by a division engineer section located in the division command post, advises the commander on engineer matters, prepares engineer estimates and plans, and performs staff supervision of division engineer activities.

3.1.5 Chemical Employment

Army units must be prepared to conduct offensive chemical operations; however, only the National Command Authority (NCA) may grant authority to employ chemical munitions. When granted, such authority will also provide specific guidance governing their use. While the use of chemical weapons does not bear the enormous strategic risks associated with nuclear weapons, it can equally alter the course of operations in a theater significantly.

Commanders must be prepared to integrate chemical weapons into their fire plans on receipt of chemical release. Because the chemical expenditure rates necessary to produce a significant effect on a well-trained, well-equipped enemy are high, commanders must carefully consider how chemical weapons will affect their own operations and logistics.

Employment of chemical weapons falls under the coordinating staff supervision of the G3; however, the division chemical officer assists the G3 by performing detailed planning for the use of chemical weapons and by preparing NBC estimates, plans, and orders.

4. CONFLICT SITUATIONS

The normative courses of staff actions of the G3 discussed in paragraph 2 above are applicable in low intensity conflict as well as mid- and high-intensity conflict. Each level of conflict, however, calls for unique applications of the tactical decisionmaking process in general and the G3's participation in that process specifically.

The growing incidence of war at the low end of the conflict spectrum demands Army action on the unique battlefields of low intensity conflict. This form of warfare falls below the level of high- and mid-intensity operations and will pit Army forces against irregular or unconventional forces, enemy special operations forces, and terrorists. Low intensity conflict poses a threat to US interests at all times, not just in periods of active hostilities. Fighting in the low end of the conflict spectrum requires special force composition and task organization, rapid deployment, and restraint in the execution of military operations.

The high- and mid-intensity battlefields are likely to be chaotic, intense, and highly destructive. They will probably extend across a wider space of air, land, and sea than previously experienced. In high- or

mid-intensity conflicts, Army forces must prepare to fight campaigns of considerable movement, not only to reduce vulnerability, but also to obtain positional advantage over the enemy. Rapid movement will be complemented by the use of advanced, highly lethal weapons throughout the battle area. Successfull attack will require isolation of the battle area in great depth as well as the defeat of enemy forces in deeply echeloned defensive areas. Successful defense will require early detection of attacking forces, prompt massing of fires, interdiction of follow-on forces, and the containment and defeat of large formations by fire and maneuver. Throughout the battle area, attack and defense will often take place simultaneously as each combatant attempts to mass, economize locally, and maneuver against his opponent.

APPENDIX B

DIVISION INTELLIGENCE ESTIMATE

16th Mech Div
NB174020
042400Z Sep ___

INTELLIGENCE ESTIMATE NR 11

Reference: Map, Series M745, Germany, Sheets 5120, 5122, 5124, 5126, 5128, 5320, 5322, 5324, 5326, 5328, 5520, 5522, 5524, 5526, 5528, 5720, 5722, 5724, 5726, 5728; 1:50,000.

1. MISSION

16 Mech Div attacks in zone 051200 Sep from present line of contact to the east; seizes terrain objectives COYOTE, FOX, and WOLF; and destroys enemy in zone to restore the Inner German Border.

2. AREA OF OPERATIONS

a. Weather

(1) Situation

	LIGHT		TEMP (F)		PRECIP		WIND		VIS				
DATE	BMNT	EENT	MIN	MAX	TYPE	AMT	DIR	VEL	KM	HUM	CLD	BAR	MOON
05 SEP	0422	2022	50	67		0.0	W	6	4.0	65	4/8	30.12	1Q
06 SEP	0424	2020	47	65		0.0	SW	10	4.0	75	5/8	29.90	1Q
07 SEP	0426	2018	42	59	RAIN	0.5	S	8	0.5	92	8/8	29.67	1Q
08 SEP	0426	2016	44	61	RAIN	0.2	S	10	1.5	95	8/8	29.79	1Q
09 SEP	0429	2014	48	66		0.0	SW	12	4.0	80	5/8	30.04	2Q

Early morning fog will be a hindrance to visibility; however, the fog should burn off by mid-morning.

Light-to-moderate precipitation, as expected on 7-8 Sep, will not interfere with cross-country movement; however, heavy rains would significantly reduce off-road mobility.

(2) Effect On Enemy Courses Of Action

Cross-country mobility is expected to be unhampered by weather for the next 48-72 hours.

Early morning fog will reduce enemy observation and effectiveness of fires against friendly forces; however, fog will also conceal enemy movements and other activities.

Aside from early morning fog, weather conditions favor enemy long range observation and fires.

Wind direction will inhibit enemy use of smoke and chemicals. Fallout patterns from any use of nuclear weapons will be detrimental to enemy forces.

Temperatures should neither help nor hinder enemy operations.

(3) Effect On Own Courses Of Action

Current weather assists friendly cross-country mobility of tracked and wheeled vehicles.

Early morning fog will assist in concealing friendly offensive operations but will hinder delivery of observed direct and indirect fires.

Generally clear skies for the next 48 hours will enhance friendly air operations.

Wind direction favors friendly use of smoke and other chemicals.

Temperatures will not hinder friendly offensive operations.

b. Terrain

(1) Situation

(a) Observation and fire

Across the division zone, from the present line of contact to the FULDA River valley, the area is heavily forested and observation and fires are restricted. East of the FULDA River to the HAUNE River and on to the IGB, observation and fields of fire improve markedly.

(b) Cover and concealment

Cover from small arms fire and concealment from air and ground observation exist in numerous forested and built-up areas in the division zone, especially immediately east of the present line of contact. Each forest stand will generally consist of either coniferous or deciduous trees, although in some areas a single forest will contain a mix of tree types.

Forested areas are mainly planted in blocks, separated by access lanes; interspersed openings are common. The coniferous stands, mainly spruce, are up to 80 feet in height, are regularly spaced about 10 feet apart, and provide concealment from air observation and some concealment from ground observation. The deciduous trees generally range from 20 to 100 feet in height and from 6 inches to 3 feet in diameter. Stands of deciduous trees will provide concealment from aerial observation for another month. The forested areas offer some cover for foot troops from flat trajectory small arms fire.

The undulating and sometimes steep terrain offers some cover from direct fires. Additionally, masonry and concrete

buildings in the cities and towns offer cover from flat trajectory fires and concealment from ground and aerial observation.

(c) Obstacles

The deeply cut valleys of the FULDA, HAUNE, and WERRA Rivers restrict east-west movement and are the primary obstacles in our sector. The SCHWALM, LEUDER, SCHLITZ, and HAUNE Rivers are generally fordable. The FULDA River south of its juncture with the SCHLITZ is also generally fordable. North of the SCHLITZ to BAD HERSFELD the FULDA River can be forded only at selected sites; north of BAD HERSFELD it is unfordable. Other streams in the division area are fordable except where bank conditions prevent entrance and exit.

Extensive anti-tank ditches and barriers have been integrated into the defenses of the Inner German Border. Additionally, terrain west of the IGB has undergone significant alteration from the effects artillery fires and engineer efforts of both sides since the attack by threat forces.

Forested areas will restrict the movement of wheeled and tracked vehicles to the existing roads and trails. These are usually plentiful but are generally soft surfaced and will be degraded rapidly during wet weather.

Built-up areas can become serious obstacles, particularly if rubbled. The cities of LAUTERBACH and SCHLITZ may present major obstacles for attacking forces if the enemy takes advantage of them by integrating them into his defenses.

(d) Key terrain features

All crossing sites of the FULDA and HAUNE Rivers in zone are key terrain as is the high ground which controls the river crossing sites. The division objectives are key to controlling the IGB in zone.

Crossing sites over the FULDA River of particular interest are:

1. Autobahn E70/A4 NE of EICHHOF (NB4933)

2. NIEDERAULA (NB4228)

3. NIEDERJOSSA (NB4025)

4. HUTSDORF (NB4115)

5. SCHLITZ (NB3914)

Other specific key terrain features are as follows:

6. The cities of LAUTERBACH (NB2810) and SCHLITZ (NB3914) which are astride a main avenue of approach to the FULDA River.

7. High ground to the immediate front of the division defined by ROTZENBERG (NB2720) - KOLLENBERG (NB2520) - AUERBERG (NB2618) - SAUSTALLSKUPPE (NB2614).

8. High ground defined by GIBGESKUPPE (NB3723) - HOHLEICHERKUPPE (NB3621) - WOLFERSBERG (NB3517) - EISENBERG (NB3516), which controls FULDA River crossing sites N of SCHLITZ.

9. High ground defined by STEINBERG (NB3312) - BACHKUPPEL (NB3612) - GUCKENBERG (NB3309), which controls FULDA River crossing sites S of SCHLITZ.

10. High ground defined by STOPPELSBERG (NB4922) - MAHNBERG (NB5124) - EICHENBERG (NB5126), which controls HAUNE River crossing sites on the northern avenue.

11. Line of hills across the southern avenue immediately in front of Objective WOLF; LICHTERBERG (NB5722) - RUCKERSBERG (NB5721) - APPELSBERG (NB5820) - STALLBERG (NB5918) - MORSBERG (NB6018).

12. The division objectives which are the high ground controlling the IGB in the division sector:

WOLF is defined by; KLEINBERG (NB6221) - KIRCHBERG (NB6420) - HAINBERG (NB6520) - HELLENBERG (NB6321),

FOX is defined by; SOISBERG (NB6226) - GRASBERG (NB6327) - LANDECKERBERG (NB6231-NB6233),

COYOTE is defined by; WALTERSBERG (NB6536) - KIRCHENKOPF (NB6637) - WEHNERRUCK (NB6639).

(e) Avenues of approach

Cross-country movement of tracked vehicles will be generally poor to undesirable. Restricted movement in the area is primarily caused by the extended forest areas, rugged hills, and mountainous landforms. The few valleys that form limited natural corridors of movement are dotted in many places with a dense pattern of built-up areas that will hinder the movement of armored vehicles. Autobahns, trunk, and secondary roads in the zone are all capable of supporting two-way traffic; however, secondary and lower quality roads may be quickly degraded by tracked vehicle traffic. Two avenues of approach are available to the objectives.

1. Avenue A, in the north, consists of two brigade-size

avenues from the present line of contact to PL APPALOOSA. These avenues are either side of and bypass the forested areas of the KOLLENBERG (NB2520), AUERBERG (NB2618), and SAUSTALLSKUPPE (NB2614).

At PL APPALOOSA, vicinity GREBENAU (NB3322), these two avenues converge into a single avenue down the JOSSA River valley to the FULDA River (PL COLT). This portion of the avenue is extremely dangerous with forested high ground on either side providing good cover and concealment for the defenders, the JOSSA River limiting the lateral movement of the forces, and little cover and concealment available in the valley.

Crossings of the FULDA River (PL COLT) would be made between NIEDERJOSSA and NIEDERAULA (NB4228). In this area the FULDA River averages 30m wide, 1.5m deep, with a velocity of 0.8m/sec. The banks average 1m high with a slope of 50 degrees. The bottom is generally rock or gravel. Forested high ground on the east bank provides the enemy with excellent defensive positions in this area, and the river valley provides virtually no cover and concealment for forces making the crossings. Once across the FULDA River, rapid advance to the HAUNE River (PL MUSTANG) should be possible.

Crossings of the HAUNE River would be made south of HAUNECK (NB5132). Again the river valley provides virtually no cover and concealment for the crossings, and the east bank provides excellent cover and concealment for enemy defensive positions. Immediately behind these positions the area opens up to provide high speed avenues with good observation and fields of fire, but with little cover and concealment, to all objectives.

2. Avenue B, in the southern portion of the division sector, begins as a brigade-size avenue passing between ANGERSBACH (NB3108) and BAD SALZSCHLIRF (NB3608). The initial portion of this avenue provides cover and concealment for the advancing force. Once beyond PL APPALOOSA, vicinity BAD SALZSCHLIRF, the force will be channelized into the SCHLITZ River valley with little cover and concealment in the valley and forested high ground on both sides controlled by the enemy. The SCHLITZ River splits this avenue and will limit lateral movement of the attacking forces.

Prior to PL COLT (FULDA River), the city of SCHLITZ splits the avenue into two avenues. Avenue B1, north of SCHLITZ, crosses the FULDA River and proceeds NE to join Avenue A for crossings of the HAUNE River north of HAUNETAL (NB4924). Avenue B2, south of SCHLITZ, is initially very narrow but once across the FULDA River it

provides sufficient space for brigade maneuver. Crossings of the FULDA River for both of these avenues have little cover and concealment. The east bank of the FULDA River provides excellent cover and concealment for enemy defensive positions.

Once any defenses of the east bank are penetrated, Avenue B2 provides excellent approaches to and crossings of the HAUNE River (PL MUSTANG) north of HUNFELD (NB5414). The area beyond PL MUSTANG, to PL PINTO and on to the objectives provides little cover and concealment but allows high speed movement and excellent maneuverability. It is, however, dominated by the line of hills from the LICHTERBERG (NB5722) to the MORSBERG (NB6018).

(2) Effect On Enemy Courses Of Action

Terrain favors the enemy's defense; first, of the forested hills to the division's front; and subsequently, of the FULDA and HAUNE Rivers and the crossing sites essential to our success.

The terrain between the present line of contact and the FULDA River will channelize our attack and will provide the enemy excellent opportunities to continue his delaying actions and to counterattack.

In the northern sector the enemy will have a distinct advantage for the defense of crossing sites of both the FULDA and HAUNE Rivers. In the southern sector the enemy defense of the FULDA River valley is also favored by the terrain.

The reserve/counterattack forces of both the 15 MRD and 10 CAA are deployed on and along Avenue B. Few routes are available for rapid movement to block or counterattack forces on Avenue A.

(3) Effect On Own Courses Of Action

Approaches to the FULDA River are narrow and restrictive and will put our forces at extreme risk to counterattack, interdiction by artillery fires, and delay by barriers or strong point defenses.

In the northern sector crossing sites for both the FULDA and HAUNE Rivers are critical to success, and enemy defense of these sites is favored by the terrain.

In the southern sector the cities of LAUTERBACH and SCHLITZ could provide significant obstacles to our advance. Crossing sites are not so critical since both the FULDA and HAUNE are generally fordable in this area; however, the terrain still provides a significant advantage to the defender for crossings of the FULDA River.

The reserve/counterattack force of the 15 MRD, the 18 MTR, and of

the 10 CAA, 33 GTD, are deployed directly on and along Avenue B. Current positions make it unlikely that these forces could be redeployed in sufficient time to have a significant impact on Avenue A.

Once east of the HAUNE River, the terrain offers good observation and fields of fire as well as high speed approaches to seize the objective generally across the division zone.

c. Other Characteristics

Skilled workers are generally available and can reasonably be expected to be helpful.

Stockpiles have been depleted; civilian population can be expected to add to the logistics burden.

The majority of the civilians remaining in the area can be expected to remain in their current locations. The LOCs should not be congested by refugees.

3. ENEMY SITUATION

a. Dispositions

The 16th Mech Div is opposed by the enemy 10 CAA and elements of the 6 CAA. Three divisions of the 10 CAA have been identified as the 15 MRD committed on the north, 24 MRD on the south, and 33 GTD in army reserve. Elements of the 93 MRR, 21 MRD (6 CAA) are committed on our extreme northern front. Three divisions (4 TD, 7 GTD, and 111 MRD) of the 14 TA have been identified in Central Front second echelon.

Divisions of the 14 TA are now known to be moving in the direction of the 10 CAA and will pose a significant threat to our operations within the next 24-36 hours.

The 18 MTR, the reserve/counterattack force of the 15 MRD, is deployed astride Avenue B between PL APPALOOSA and PL COLT.

The 33 GTD is currently deployed in the southern portion of the division sector with two regiments on the FULDA River and two on the HAUNE River, directly on or along Avenue B. Positions have been prepared for defense in this area; however, the division is also poised to take advantage of any opportunity for counterattack.

See current situation map for 041800 Sep.

b. Composition

See OPFOR composition report for 041800 Sep.

c. Strength

It is apparent that the three divisions of the 10 CAA, as well as the elements of the 6 CAA, opposing the 16 Mech Div have suffered heavy personnel and materiel losses over the past ten days. Enemy priority to operations on the Northern Front has reduced the availability of both individual and unit replacements to the units opposing our division. Combat effectiveness of a number of enemy units is becoming marginal as a result of low personnel strength. Some battalions have been eliminated through consolidations to reconstitute effective maneuver battalions.

(1) Committed

See OPFOR committed report for 041800 Sep.

(2) Reinforcements

See OPFOR reinforcements report for 041800 Sep.

(3) Artillery

See OPFOR artillery report for 041800 Sep.

(4) Air

OPFOR ground forces are supported by the 4th Air Army consisting of unidentified numbers of fighter bomber, ground attack, and reconnaissance aircraft. Air parity currently exists, with either force capable of obtaining air superiority for limited periods of time. Over the last several days, OPFOR has employed a maximum of 25 fighter-bomber sorties in our zone in a 12-hour period.

(5) Nuclear, Chemical, and Biological Weapons

No estimate of OPFOR nuclear support for the next 30 days is available. OPFOR currently has 152mm gun/howitzers and surface-to-surface missiles capable of delivering 0.5 to 50 KT yield weapons within range of our division.

No estimate of OPFOR chemical and biological capability is available.

d. Enemy Recent Activities

Enemy units in contact have been fighting hard for the last 9-12 days and have taken relatively heavy casualties. Low personnel and equipment strengths have dictated reduced defensive frontages for enemy frontline battalions and regiments. These units continue to withdraw rather than become decisively engaged.

POW reports continue to indicate that limited personnel replacements, either individuals or units, are being received by enemy frontline units of the 6 CAA and 10 CAA; however, a number of reports indicate that replacements and reinforcements are imminent. There are also reports that 15 MRD will soon be relieved. Unit consolidations and/or

reorganizations are being accomplished to accommodate reduced strengths.

Enemy continues to experience resupply problems, it appears that his supply priority is to artillery and missile munitions. Reports indicate artillery is the only ammunition not in short supply. Artillery fires continue to be heavy and accurate, confirming this.

The 33 GTD has redeployed to the north of FULDA and now occupies positions along and overlooking both the FULDA and HAUNE Rivers.

Large unit movements detected in the area 50 to 75 km NE indicate elements of 14 TA are now moving toward the 10 CAA sector.

Refugee reports indicate that forced civilian labor is being used throughout the area to assist in construction efforts.

The enemy has not used nuclear weapons anywhere along the European front, and there are no confirmed reports of his use of either chemical or biological weapons. Along the 10 US Corps front the enemy may have lost the opportunity for initiative use of NBC weapons because of the proximity to his homeland and the threat of friendly retaliation.

e. Enemy Peculiarities and Weaknesses

(1) Personnel

Strengths of 10 CAA and 6 CAA divisions in both first and second echelon units is between 60-65 percent which is approaching marginal combat effectiveness. Consolidations at battalion level have been and will continue to be used to maintain combat effectiveness of units. Despite the low strength, morale is moderately high based upon OPFOR successes on other fronts and the promise of personnel and equipment replacements.

(2) Intelligence

Enemy intelligence and counterintelligence activities continue at a high state of effectiveness as evidenced by his efficient reaction to friendly offensive operations. Stay-behind elements appear to be feeding information to the enemy, and his intercept of radio and other electronic transmissions appears to contribute to his operations planning and performance.

(3) Operations

OPFOR first and second echelon forces continue to be combat effective despite significant personnel and materiel losses. This is probably due to the high state of training and good leadership. OPFOR tactical doctrine is being adapted to current battlefield conditions as evidenced by apparently reduced defensive frontages, organization of defenses by echelon, fewer counterattacks to conserve resources, and continued reliance on massed

artillery.

(4) Logistics

The inability to replace key equipment items in frontline units is obvious. Supply of POL does not appear to be critical yet, and the enemy continues to demonstrate mobility on the battlefield. Artillery munitions appear to have priority for resupply as evidenced by continuing intensity of indirect fires on friendly forces and positions. This priority is confirmed in PW reports. Other munitions and repair parts are apparently in short supply. Enemy interior lines of communication appear to continue to effectively support combat operations, and his logistical situation is by no means critical.

(5) Civil-Military Operations

Civilian refugees are few in number and are being screened to identify those with enemy sympathies. Those suspected of such sympathies are being detained and evacuated to ensure that they do not interfere with friendly operations.

(6) Personalities

General-Lieutenant Reznichenco continues to command 10 CAA and to lead effectively; very able tactician and very well respected.

General-Lieutenant Gusarov is reported to now command the 6 CAA replacing General-Lieutenant Melinkov. Gusarov, a former line artillery officer, is a strong proponent of massed artillery fires in support of other ground forces.

CG of 21 MRD is unknown. General-Major Aranov was reported wounded in August and was apparently replaced.

CG of 15 MRD, General-Major Birukov, is a stable, patient, and effective former infantry officer. He is well respected and an able leader.

CG of 24 MRD, General-Major Radzievskiy, is an aggressive tactician and a protege of General-Colonel Buschenkov, the Central Front commander. Radzievskiy is arrogant and not well liked by the rank and file of the division; however, he is well respected for his military expertise.

General-Major Sagaydak, CG of 33 GTD, is a military politician, young and relatively unknown. He has been in command less than 90 days.

4. ENEMY CAPABILITIES

a. Possible Courses of Action

Defend present line of contact with elements of four motorized rifle regiments and one tank regiment, supported by normal divisional and regimental artillery.

Delay (or continue hasty defense) from present line of contact to, and defend, the FULDA or HAUNE River lines with elements of four motorized rifle regiments and one tank regiment supported by normal divisional and regimental artillery.

Counterattack, given any opportunity, with elements of the 33 GTD; three MTR and one MRR supported by normal divisional and regimental artillery.

Reinforce his defense at any time with three tank regiments and one MRR of 33 GTD and other reinforcing units (see OPFOR reinforcement report for 041800 Sep).

Counterattack or reinforce his defense with elements of the 14 TA; two Tank Div's and one Motorized Rifle Div.

Employ nuclear weapons of 0.5 to 50 KT yield at any time with delivery by artillery, surface-to-surface missiles, or tactical air.

Employ chemical agents in our sector at any time.

Attack the division area with an undetermined number of fighter bomber and ground attack sorties daily. Maximum number of daily sorties mounted in our sector has been 48.

b. Analysis and Discussion

Defend present line of contact. Present condition of enemy forces make this an unacceptable enemy course of action. The lower VOGELSGERG provides good defensible terrain which, if vigorously defended, could delay friendly forces restoration of the IGB. Defense of the present line would require reinforcement of the present forces and would exact significant OPFOR casualties at a time when OPFOR is already marginally combat effective.

Delay (or continue hasty defense) to, and defend, the FULDA or HAUNE River line. An effective delaying action from present positions to the FULDA River will permit the development of strong defensive positions on the most defensible terrain in the division zone. Concomitantly, the delaying action will buy time for resupply and will exact friendly casualties in the process.

Counterattack with elements of 33 GTD. This capability, if exercised, would have a detrimental effect on 16 Mech Div mission accomplishment. Enemy dispositions and current activities make this capability a distinct possibility. The 33 GTD is positioned to begin a

counterattack at any time.

Reinforce his defense. Present enemy dispositions indicate that this capability is highly probable, either in defense of the present line of contact or in defense of the FULDA River line. The 33 GTD is currently deployed in this area and elements of the 14 TA are known to be moving in the direction of the 10 CAA sector and could be in reinforcing positions within 24-36 hours.

Counterattack with the 14 TA. Elements of the 14 TA are within range to provide rapid reinforcement (within 24-36 hours). Recon elements have been detected on routes leading into the 10 CAA sector. The doctrinal role for this army would be counterattack and although it may initially be used to bolster the defense it can be expected to launch a counterattack at the earliest opportunity.

Employ nuclear weapons. There are no indications that the enemy will employ tactical nuclear weapons.

Employ chemical agents. There are no indications that the enemy will employ chemical weapons. Prevailing westerly winds do not favor this capability along the present line of contact.

Conduct air attacks in the division sector. All indications are that air strikes against divisional forces will continue, with a level of effort of approximately 40 sorties per day.

5. CONCLUSIONS

a. Effect Of Intelligence Considerations On Operations

The mission can be supported from an intelligence standpoint.

Reduced personnel and materiel strengths in first and second echelon regiments indicate that friendly offensive operations can be successful in the near term.

Particular attention must be paid to the enemy reinforcing and counterattack capabilities which, if exercised, could detrimentally affect our mission.

b. Effect Of Area Of Operation On Own Courses Of Action

Terrain will canalize our attack making it highly susceptible to enemy delaying tactics and/or counterattack. The FULDA and HAUNE Rivers are significant obstacles to our advance, and the FULDA, in particular, provides excellent defensive positions to the enemy.

Weather will ensure good observation and fields of fire for the next three days to facilitate our ground and air operations.

c. Probable Enemy Courses Of Action

Delay (or continue hasty defense) to the FULDA River.

Counterattack by the 33 GTD in the southern half of 16 Mech Div sector at any opportunity.

Counterattack with elements of the 14 TA.

Attack our area with fighter, ground attack, and bomber aircraft.

d. Enemy Vulnerabilities

Reduction in combat power in first and second echelon regiments of the 15 and 24 MRD's resulting from recent combat operations.

Extended frontages for frontline units.

Reduced supplies of munitions (except artillery).

Relative reduction in available air sorties for employment in the 16 Mech Div zone.

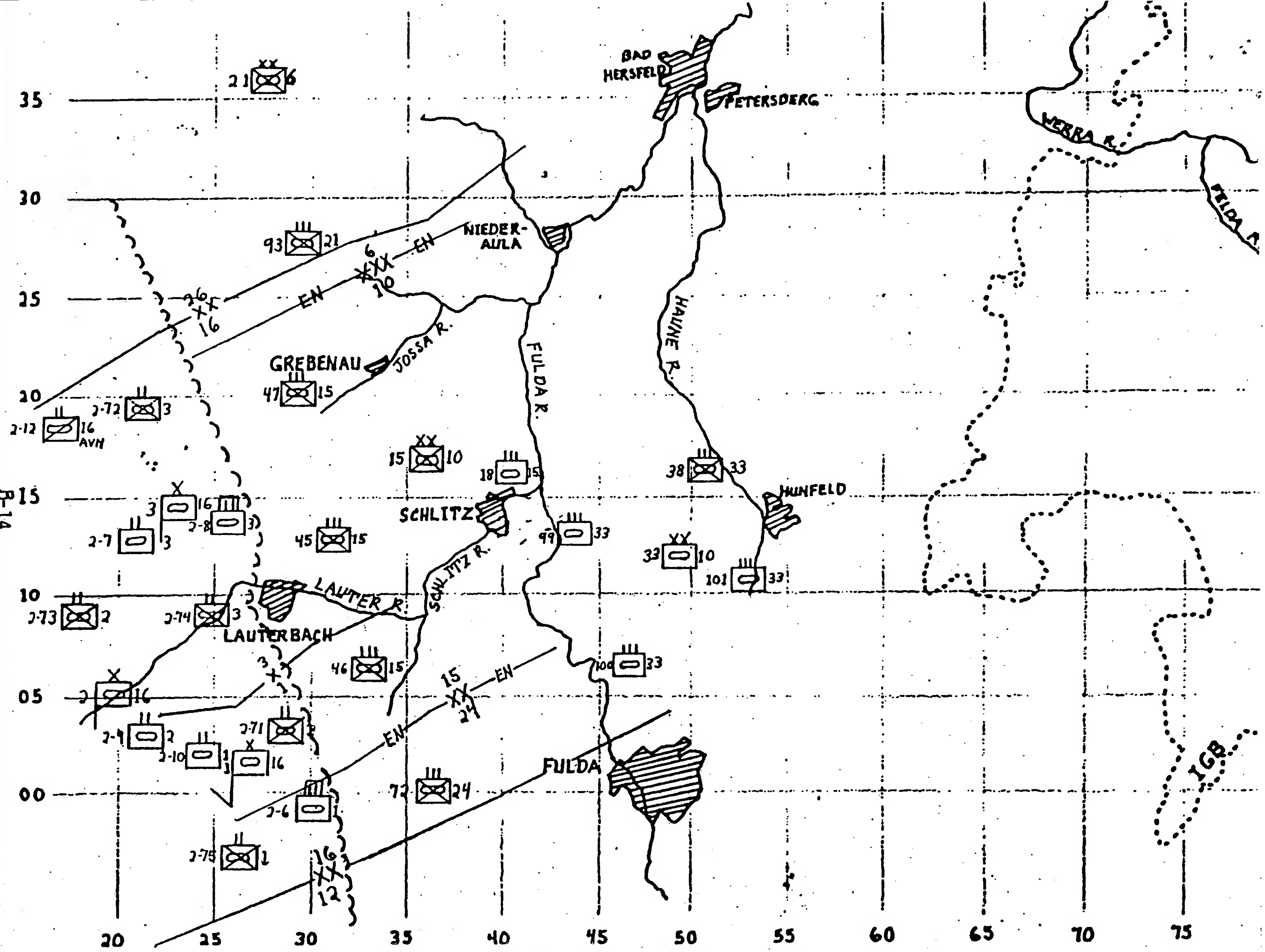


Figure B-1. SITUATION AS OF 041800 SEPTEMBER

APPENDIX C

DIVISION OPERATIONS ESTIMATE

16th Mech Div
NB174020
042400Z Sep ___

OPERATIONS ESTIMATE 9

Reference: Map, Series M745, Germany, Sheets 5120, 5122, 5124, 5126, 5128, 5320, 5322, 5324, 5326, 5328, 5520, 5522, 5524, 5526, 5528, 5720, 5722, 5724, 5728; 1:50,000.

1. MISSION

16 Mech Div attacks 051200 Sep from present line of contact in the direction LAUTERBACH (NB2809) - SCHLITZ (NB3913) - EITERFELD (NB5624); conducts crossings of the FULDA and HAUNE Rivers in zone; seizes terrain objectives COYOTE, FOX, and WOLF; destroys enemy in zone; and consolidates positions along the Inner German Border (IGB).

2. THE SITUATION AND CONSIDERATIONS

a. Considerations Affecting the Possible Courses of Action.

(1) Characteristics of the area of operations.

(a) Weather. See Weather Forecast for 041800 Sep.

The weather in the area of operations is not expected to impact either friendly or enemy operations to any significant degree. Early morning fog will hamper observation and effectiveness of fires of both sides until it burns off about 0900 hours. Air operations, both CAS and reconnaissance, are expected to be impeded on both sides during periods of early morning fog. Precipitation will not affect cross-country mobility for the next 48-72 hours and, after that period, the limited amount of rain predicted for 7-8 Sep is not expected to affect mobility of either friendly or enemy forces. Wind direction favors friendly use of smoke and chemicals while reducing the effectiveness of their use by the enemy.

(b) Terrain.

1. Observation and fire

Across the division zone, from the present line of contact to the FULDA River valley, the area is heavily forested and observation and fires are restricted. East of the FULDA River and beyond the HAUNE River to the IGB, observation and fields of fire improve markedly.

2. Cover and concealment

Cover from small arms fire and concealment from air and ground observation exists in numerous forested and built-up areas in the division zone, especially immediately east of the present line of contact. The undulating and sometimes steep terrain offers some cover from direct fires. Additionally, masonry and concrete buildings in the cities and towns offer cover from flat

trajectory fires and concealment from ground and aerial observation.

3. Obstacles

Large scale movement by wheeled and tracked vehicles is considerably restricted in the forested areas and in some of the built-up areas. The deeply cut valleys of the FULDA, HAUNE, and WERRA Rivers restrict east-west movement to some extent. The SCHWALM, LEUDER, SCHLITZ, and HAUNE Rivers are generally fordable. The FULDA River south of its juncture with the SCHLITZ is also generally fordable. North of the SCHLITZ to BAD HERSFELD the FULDA River can be forded only at selected sites; north of BAD HERSFELD it is unfordable. Other streams in the division area are fordable except where bank conditions prevent entrance and exit.

Built-up areas can become serious obstacles, particularly if rubbled. The cities of LAUTERBACH and SCHLITZ may present major obstacles for attacking forces.

4. Key terrain features

All crossing sites of the FULDA and HAUNE Rivers in zone are key terrain as is the high ground which controls the river crossing sites. The division objectives are key to controlling the IGB in zone.

Crossing sites over the FULDA River of particular interest are:

a. Autobahn E70/A4 NE of EICHHOF (NB4933)

b. NIEDERAULA (NB4228)

c. NIEDERJOSSA (NB4025)

d. HUTSDORF (NB4115)

e. SCHLITZ (NB3914)

Other specific key terrain features are as follows:

a. The cities of LAUTERBACH (NB2810) and SCHLITZ (NB3914) which are astride a main avenue of approach to the FULDA RIVER.

b. High ground to the immediate front of the division defined by ROTZENBERG (NB2720) - KOLLENBERG (NB2520) - AUERBERG (NB2618) - SAUSTALLSKUPPE (NB2614).

c. High ground defined by GIBGESKUPPE (NB3723) - HOHLEICHERKUPPE (NB3621) - WOLFERSBERG (NB3517) -

EISENBERG (NB3516), which controls FULDA River crossing sites N of SCHLITZ.

d. High ground defined by STEINBERG (NB3312) - BACHKUPPEL (NB3612) - GUCKENBERG (NB3309), which controls FULDA River crossing sites S of SCHLITZ.

e. High ground defined by STOPPELSBERG (NB4922) - MAHNBERG (NB5124) - EICHENBERG (NB5126), which controls HAUNE River crossing sites on the northern avenue.

f. Line of hills across the southern avenue immediately in front of Objective WOLF; LICHTERBERG (NB5722) - RUCKERSBERG (NB5721) - APPELSBERG (NB5820) - STALLBERG (NB5918) - MORSBERG (NB6018).

g. The division objectives which are the high ground controlling the IGB in the division sector:

WOLF is defined by; KLEINBERG (NB62210 - KIRCHBERG (NB6420) - HAINBERG (NB6520) - HELLENBERG (NB6321),

FOX is defined by; SOISBERG (NB6226) - GRASBERG (NB6327) - LANDECKERBERG (NB6231-NB6233),

COYOTE is defined by; WALTERSBERG (NB6526) - KORCHENKOPF (NB6637) - WEHNERRUCK (NB6639).

5. Avenues of approach

Cross-country movement of tracked vehicles will be generally poor to undesirable. Restricted movement in the area is primarily caused by the extended forest areas, rugged hills, and mountainous landforms. The few valleys that form limited natural corridors of movement are dotted in many places with a dense pattern of built-up areas that will hinder the movement of armored vehicles. Autobahns, trunk roads, and secondary roads in the zone will support two-way traffic; however, secondary and lower quality roads will be quickly degraded by tracked vehicle traffic.

Two avenues of approach are available to the objectives.

a. Avenue A, in the north, consists of two brigade-size avenues from the present line of contact to PL APPALOOSA. These avenues are either on side of and bypass the forested areas of the KOLLENBERG (NB2520), AUERBERG (NB2618), and SAUSTALLSKUPPE (NB2614).

At PL APPALOOSA, vicinity GREBENAU (NB3322), these two avenues converge into a single avenue down the

JOSSA River valley to the FULDA River (PL COLT). This portion of the avenue is forested and is controlled by high ground on either side; the JOSSA River limits the lateral movement of the forces; and little cover and concealment is available in the valley.

Crossings of the FULDA River (PL COLT) would be made between NIEDERJOSSA and NIEDERAULA (NB4228). In this area the FULDA River averages 30m wide, 1.5m deep, with a velocity of 0.8m/sec. The banks average 1m high with a slope of 50 degrees. The bottom is generally rock or gravel. Forested high ground on the east bank provides the enemy with excellent defensive positions in this area, and the river valley provides virtually no cover and concealment for forces making the crossings. Once across the FULDA River, rapid advance to the HAUNE River (PL MUSTANG) should be possible.

Crossings of the HAUNE River would be made south of HAUNECK (NB5132). Again the river valley provides virtually no cover and concealment for the crossings, and the east bank provides excellent cover and concealment for enemy defensive positions; however, immediately behind these positions the area opens up to provide high speed avenues with good observation and fields of fire, but with little cover and concealment, to all objectives.

b. Avenue B, in the southern portion of the division sector, begins as a brigade-size avenue passing between ANGERSBACH (NB3108) and BAD SALZSCHLIRF (NB3608). The initial portion of this avenue provides cover and concealment for the advancing force. Once beyond PL APPALOOSA, vicinity BAD SALZSCHLIRF, the force will be channelized into the SCHLITZ River valley with little cover and concealment in the valley and forested high ground on both sides. The SCHLITZ River splits this avenue and will limit lateral movement of the attacking forces.

Immediately west of PL COLT (FULDA River), the city of SCHLITZ splits the avenue into two avenues. Avenue B1, north of SCHLITZ, crosses the FULDA River and proceeds NE to join Avenue A for crossings of the HAUNE River north of HAUNETAL (NB4924). Avenue B2, south of SCHLITZ, is initially very narrow but once across the FULDA River it provides sufficient space for brigade maneuver. Crossings of the FULDA River for both of these avenues have little cover and concealment. The east bank of the FULDA River provides excellent cover and concealment for enemy defensive positions.

Once defenses of the east bank are penetrated, Avenue B2 provides excellent approaches to and crossings of the HAUNE River (PL MUSTANG) north of HUNFELD (NB5414). The area beyond PL MUSTANG, to PL PINTO and on to the objectives, provides little cover and concealment but allows high speed movement and excellent maneuverability.

(c) Other pertinent factors.

The area of operations lies in the Federal Republic of Germany (FRG); therefore, the civilian populace remaining in the area can be expected to be friendly and should not intentionally hinder friendly operations. For the same reason, they may be expected to impede enemy operations if only by resisting enemy control and by disrupting, to the limit of their capability, enemy operations. The extent to which the populace can impede enemy operations is unknown.

(2) Enemy situation.

(a) Dispositions. See Operations Overlay for 041800 Sep.

(b) Composition. See OPFOR Task Organization for 041800 Sep.

16 Mech Div is opposed principally by major elements of the 10th CAA but also by elements of an MRR of the 6th CAA on our northern boundary. First echelon forces of the 10 CAA to our front consist of the 15 MRD and elements of the 24 MRD. 6 CAA first echelon forces consist of elements of the 21 MRD. All three of the enemy first echelon divisions have been severely punished by NATO forces over the past several weeks and are estimated to be only 60-65 percent combat effective. Second echelon forces of the 10 CAA consist principally of the 33 GTD which is also estimated to be about 65 percent combat effective.

Enemy Central Front reserves include the 14 TA consisting of the 4 TD, 7 GTD, and 111 MRD, all of which are estimated to be 85-90 percent combat effective.

15 MRD is deployed in the northern portion of our division zone of operations. Its defensive zone is unusually wide and, coupled with reduced personnel and materiel strength in the division, all three MRRs of the division are deployed on line as the division's first echelon forces. The division's second echelon force is the 18 MTR, which is primarily the division's counterattack force. The division does not have a second echelon MRR. None of the MRRs of the 15 MRD has an MRBN available for its second echelon since each of the regiments has consolidated its motorized elements into two MRBNs. Each MRR retains its organic MTBN as its counterattack force, and each must use its tanks to defend in the regimental second echelon when required. The regimental

ATGM batteries will most likely be used along the most dangerous avenues of approach into the regimental sector. The regimental artillery battalions are positioned to provide indirect fires primarily but, in the event of a penetration, may be used in a direct fire role. Regimental artillery groups (RAGs) appear to be organized as follows:

45 RAG: 60 ARTY (122T) and 42 ARTY (122T) at 55 and 65 percent combat effectiveness respectively.

46 RAG: 64 ARTY (122T) and 43 ARTY (152 SP) at 50 and 70 percent combat effectiveness respectively.

47 RAG: 31 ARTY (122 SP) and 41 ARTY (122T) at 55 and 60 percent combat effectiveness respectively.

The 15 DAG appears to consist of the organic 11 MRL Bn (122) at 55 percent, the 29 SS21 Bn at 50 percent, and the 13 ARTY Bn (130T) at 65 percent effectiveness. The 58 MRL Regt (3 MRL Bns) is firing in GS of 15 MRD.

24 MRD is deployed opposite the 16 Mech Div in the south. Its defensive zone is more normal in width, and the division has two MRRs (72 MRR and 73 MRR) deployed on line as its first echelon force. 74 MRR is deployed as the 24 MRD second echelon force, and the 37 MTR is positioned as the division counterattack force. The 23 AT Bn is sited to cover the most likely avenue of approach into the division's defensive position. RAGs of the 24 MRD appear to be constituted as follows:

72 RAG: 66 ARTY (122T), 69 ARTY (122T), and 34 ARTY (152 SP) at 60 percent, 60 percent, and 65 percent combat effectiveness respectively.

73 RAG: 51 ARTY (122T), 57 ARTY (122T), and 81 ARTY (152 SP) at 55 percent, 60 percent, and 60 percent combat effectivensss respectively.

74 MRR: 91 ARTY (122 SP) at 55 percent combat effectiveness (24 MRD second echelon).

The 24 DAG appears to consist of the organic 3 MRL Bn (122) at 55 percent, the 75 SS21 Bn at 50 percent, 20 ARTY (130T) at 65 percent, 39 ARTY (130T) at 70 percent, and 78 ARTY (152 SP) at 70 percent effectiveness.

10 CAA does not have assigned an MRD which can be deployed as the CAA second echelon force; therefore, the 33 GTD must fulfill the dual role of second echelon force as well as principal CAA counterattack force. 33 GTD is at about 65 percent combat effectiveness and is deployed in depth between the FULDA and HAUNE Rivers. The 33 GTD can assume one of three possible missions; i.e., defense of FULDA

River, defense of HAUNE River, or counterattack. Regiments of the division apparently retain control of their organic artillery battalions, and the division apparently retains control of its organic artillery regiment.

21 MRD of 6 CAA has the 93 MRR deployed on the 16 Mech Div north flank. Two consolidated MRBNs of the 93 MRR are deployed as regimental first echelon forces with one MTBN as the regimental counterattack force. The 89 ARTY (122T) is the organic regimental artillery battalion supporting the 93 MRR, and other unidentified artillery battalion(s) are probably supporting the regiment.

(c) Enemy strength. See OPFOR Equipment Report for 041800 Sep.

1. OPFOR Committed Report for 041800 Sep.

2. OPFOR Reinforcement Report for 041800 Sep.

3. OPFOR Artillery Report for 041800 Sep.

4. Enemy has employed an average of 25 fighter-bomber sorties per 12 hour period in the 16 Mech Div zone of operations and can be expected to continue with that capability.

5. Enemy nuclear and chemical capabilities for the next 30 days are unknown but he has 152 mm howitzers and SSM which are nuclear-capable.

(d) Recent and present significant activities.

1. 10 CAA and 6 CAA continue to conduct a hasty defense/withdrawal action across the 16 Mech Div front.

2. 33 GTD has been redisposed to positions between the FULDA and HAUNE Rivers; division positioning makes enemy intentions difficult to interpret.

3. Enemy CAS missions continue to be directed against friendly forces.

4. Enemy is repositioning elements of 14 TA to locations in 10 CAA rear areas.

5. 10 CAA is experiencing resupply problems.

6. There are no indications of the use of nuclear or chemical munitions by the enemy.

7. Estimated enemy personnel and key equipment strengths indicate that frontline units are approaching marginal combat effectiveness.

(e) Peculiarities and weaknesses.

1. Enemy forces in contact are overextended in frontage defended, yet they continue to fight tenaciously as NATO forces approach the Warsaw Pact homeland.

2. Resupply problems exist in all classes except for artillery ammunition.

3. Enemy artillery firepower continues to be a major element in the enemy defensive operations.

4. Enemy unit consolidations within frontline regiments underscore loss of enemy combat power. The enemy is not able to organize his defensive positions in depth and consequently is vulnerable to strong friendly penetration operations.

(3) Own situation.

(a) Dispositions. See Operations Overlay for 041800 Sep.

16 Mech Div is deployed with two brigades on line; 3d Bde in the north and 1st Bde in the south. Each frontline brigade has two mechanized infantry and two tank battalions attached. 2d Bde in division reserve has one mechanized infantry and one tank battalion attached. The division is supported by eight artillery battalions and the organic MLRS battery. Three attack helicopter battalions are available to support the division. Other combat support and CSS units are disposed to support the division.

(b) Composition. See BLUEFOR Task Organization for 041800 Sep. See BLUEFOR Equipment Report for 041800 Sep.

16 Mech Div has all of its organic units and is at approximately 85 percent strength. Corps units attached to the division are the 6 FA Bde (two 203 mm howitzer and three 155 mm howitzer battalions), 173d AH Bn, 55 Engr Cmbt Bn, 5th Engr MAB Co, and 3 Smk Gen Co.

(c) Strength. See BLUEFOR Strength Report for 041800 Sep.

(d) Recent and present significant activities.

16 Mech Div continues to conduct successful offensive operations against a weakening enemy. Daily advances have averaged 8-10 kilometers across the division front. Friendly attack helicopters and CAS sorties continue to be highly effective. Frontages assigned to the division coupled with relative combat power ratio has precluded penetration and exploitation of enemy defenses.

(4) Relative combat power.

(a) Maneuver forces.

US				Warsaw Pact			
Unit	Value	%	Total	Unit (Type)	Value	%	Total
2-71 IN	2.0	.790	1.58	1-45 (BTR)	1.0	.75	.75
2-72 IN	2.0	.804	1.61	3-45 (BTR)	1.0	.80	.80
2-73 IN	2.0	.952	1.90	4-45 (T72)	2.0	.70	1.40
2-74 IN	2.0	.844	1.69	1-46 (BTR)	1.0	.75	.75
2-75 IN	2.0	.849	1.70	2-46 (BTR)	1.0	.75	.75
2-6 AR	3.0	.895	2.69	4-46 (T72)	2.0	.70	1.40
2-7 AR	3.0	.810	2.43	2-47 (BMP)	1.5	.75	1.13
2-8 AR	3.0	.795	2.39	3-47 (BMP)	1.5	.75	1.13
2-9 AR	3.0	.931	2.79	4-47 (T64)	2.0	.65	1.30
2-10 AR	3.0	.873	2.62	1-18	1.6	.65	1.04
2-12 AR	2.0	.847	1.69	2-18	1.6	.65	1.04
101 AH	4.0	.782	3.13	3-18	1.6	.65	1.04
102 AH	4.0	.847	3.39	211 RCN	1.0	.70	.70
173 AH	4.0	.914	3.66	19 AT	1.0	.60	.60
				44 HCPT	2.0	.55	1.10
			33.27				14.93

Combat power ratio (maneuver units) = 2.23:1

(b) Artillery.

2-32 FA	2.0	.803	1.61	60 ARTY	2.0	.55	1.10
2-33 FA	2.0	.792	1.58	64 ARTY	2.0	.50	1.00
2-34 FA	2.0	.845	1.69	31 ARTY	2.0	.55	1.10
2-616 FA	2.0	.850	1.70	54 ARTY	2.0	.60	1.20
2-628 FA	2.0	.850	1.70	41 ARTY	2.0	.60	1.20
2-631 FA	2.0	.878	1.76	42 ARTY	2.0	.65	1.30
2-632 FA	2.0	.829	1.66	43 ARTY	2.0	.70	1.40
2-635 FA	2.0	.853	1.71	11 MRL	1.0	.55	.55
16 MLRS	2.0	.833	1.67	13 ARTY	2.0	.65	1.30
				29 SS21	2.0	.50	1.00
				32 MRL	1.0	.70	.70
				50 MRL	1.0	.60	.60
				61 MRL	1.0	.65	.65
			15.08				13.10

Combat power ratio (artillery) = 1.15:1

(c) Combat multipliers.

32 CAS sorties
1 ADA Bn
1 MI Bn
2 Engr Cbt Bn
2 Engr Brg Co
1 Smk Gen Co

(d) General.

1. The enemy in the division zone is both overextended and fatigued from a long period of fighting. We can take advantage of the current combat power ratio by selecting a favorable division avenue of approach and concentrating our combat power to effect a penetration of the enemy's hasty defensive positions.

2. Particular attention must be paid to the 18 MTR of the 15 MRD. This regiment can effectively counterattack any penetration we may make unless we can attack him and reduce his mobility. Attention must also be given to the 33 GTD which can, in whole or in part, be committed to counterattack any friendly penetration. Artillery and attack helicopters can effectively reduce the enemy's combat power and counterattack capability.

b. Enemy Capabilities.

(1) Capability #1: Defend present line of contact with elements of four MRR and one MTR, supported by normal divisional and regimental artillery plus attached army artillery.

The relative combat power between opposing forces does not favor an enemy position defense of his present line of contact. His forces are not disposed on terrain especially suited for an integrated position defense, and none of his current activities indicates such a defense. Should the enemy attempt a position defense along the present line of contact, such a course of action would facilitate our mission since it would allow us to mass forces to penetrate his positions and to exploit the penetration with a high probability of success. All indications are, however, that it is highly improbable that the enemy will exercise a position defense capability at this time.

(2) Capability #2: Delay (or continue hasty defense) from present line of contact to, and defend, the FULDA or HAUNE River lines with elements of four MRR and one MTR, supported by normal divisional and regimental artillery plus attached army artillery.

Enemy forces in our zone of operations are overextended considering Warsaw Pact operational doctrine. The enemy has been exercising this capability, however, for several weeks, and the terrain supports his continuation of the capability. His force dispositions, including local reserves, also indicate that he will continue to exercise this capability. Exercising this capability will afford enemy second echelon forces time to prepare for position defense of the FULDA and HAUNE Rivers. Exercise of this capability by the enemy, coupled with effective local counterattacks, will impede early accomplishment of our mission.

(3) Capability #3: Reinforce his defense at any time with three MTR and one MRR of the 33 GTD supported by normal divisional and

regimental artillery.

While Soviet operational doctrine normally employs the larger armor units in a counterattack role, 10 CAA has no MRD to employ as a second echelon force; therefore, 33 GTD must fulfill roles both as a second echelon defensive force and a counterattacking force. It is unclear which role the 33 GTD is presently assigned since it has elements of the division positioned at both the FULDA and HAUNE Rivers. There are indications that the 33 GTD is capable of reinforcing the enemy defense at either the FULDA or HAUNE Rivers or both. Commitment of the 33 GTD in a reinforcing role in our division zone would impede the early accomplishment of our division mission; however, pinning down the 33 GTD in reinforcement in our zone would facilitate 10 (US) Corps mission accomplishment in a penetration and exploitation by the 32d Armored Division. The reinforcement capability by the 33 GTD cannot be ruled out, but it is less probable than its employment in a counterattack role.

(4) Capability #4: Counterattack at a place and time of his choosing with three MTR and one MRR of the 33 GTD supported by normal divisional and regimental artillery.

The doctrinal role for armor units is traditionally one of attack or counterattack, and there is no reason to believe that the 10 CAA commander will depart from tradition. Although the 33 GTD has elements deployed at both the FULDA and HAUNE River lines, the division is positioned so as to facilitate rapid commitment in a counterattack role. Excellent avenues of approach are available to the 33 GTD to counterattack our division or to counterattack a penetration by the 32d Armored Division to our south. A counterattack of our division by the 33 GTD would seriously affect accomplishment of our division mission, but such a counterattack would significantly enhance accomplishment of the 10 (US) Corps mission through penetration and exploitation by the 32d Armored Division. On the other hand, a 33 GTD counterattack of a 32d Armored Division penetration would expose the flank of the counterattack to the combat power of the 16 Mech Div. The probability of adoption of this counterattack capability is raised appreciably by the proximity of elements of the 14 TA to the 10 CAA zone of operations.

(5) Capability #5: Reinforce the defense with elements or all of the 14 TA (2 TD and 1 MRD).

Elements of the 14 TA are moving in the direction of the 10 CAA zone of operations with the likely missions of either reinforcement or counterattack. Movement of the 14 TA on multiple routes indicates that the enemy is not simply repositioning his forces but will commit those forces in either of the two roles identified. The more likely initial mission is to reinforce the defense of the Central Front to prevent a penetration by NATO forces into the Warsaw Pact homeland. Quite likely this role will be later overridden by a strong counterattack of NATO

forces. 14 TA is in a position to reinforce the defense on a piecemeal basis within 18 hours and fully reinforce the defense within 36 hours unless the tank army is heavily engaged by friendly air and SSM attacks in the interim period. Such a reinforcement will seriously impede accomplishment of the 16 Mech Div mission.

(6) Capability #6: Counterattack the 16 Mech Div with major elements of the 14 TA (2 TD and 1 MRD).

14 TA is moving toward the 10 CAA zone of operations and should be in a position to launch a coordinated division-size or larger counterattack against the 16 Mech Div within 36 hours unless heavily engaged by NATO forces in the interim period. A counterattack by the 14 TA would seriously jeopardize the accomplishment of the 16 Mech Div mission.

(7) Capability #7: Employ tactical nuclear weapons of 0.5 to 50 KT yield at any time with delivery by artillery, SSM, or tactical air.

There are no indications that the enemy will employ tactical nuclear weapons at this time. Considering the proximity of the battle to Warsaw Pact homeland, the enemy will probably refrain from the initiative use of tactical nuclear weapons.

(8) Capability #8: Employ chemical weapons.

There are no indications that the enemy will employ chemical agents. Prevailing weather conditions and proximity to Warsaw Pact homeland mitigate against the enemy use of chemical weapons.

(9) Capability #9: Conduct air attacks in the division sector. All indications are that enemy air strikes against the division will continue with a level of effort of at least 40 sorties per day.

The most probable enemy course of action is to continue his hasty defense west of the IGB coupled with a major counterattack by the 33 GTD at the earliest tactical opportunity against any major NATO penetration.

Reinforcement of the defense or counterattack by the 14 TA is highly probable within 36 hours.

Continued air operations against the division in conjunction with the hasty defense and/or counterattack is highly probable.

c. Own Courses of Action.

CA 1: Attack at 051200 Sep with two brigades on line with the main attack in the north on the avenue GREBENAU (NB3322)-JOSSA River valley-NIEDERJOSSA (NB4025) (Avenue A); seize crossings over the FULDA River, and continue the attack eastward to seize Objective ALPHA .

CA 2: Attack at 051200 Sep with two brigades on line with the main attack in the south in the direction LAUTERBACH (NB2809)-SCHLITZ (NB3913)-BURGHAUN (NB5116) (Avenue B); seize crossings over the FULDA River; and continue the attack eastward to seize Objective ALPHA.

3. ANALYSIS OF COURSES OF ACTION

a. 16 Mech Div's assigned mission, objectives, and control measures restrict the available courses of action to division main attacks along Avenue A (CA 1) or Avenue B (CA 2). Avenues of approach A and B are analyzed in paragraph 2. a. (1) (b) above.

b. The most likely enemy capability is to continue to conduct a hasty defense coupled with counterattacks by

(a) 18 MTR or elements thereof, and/or

(b) 33 GTD or elements thereof.

c. Analysis of the enemy situation reveals

(1) Strengths

(a) Defensive positions are well sited and provide excellent observation and fields of fire.

(b) Excellent covered and concealed routes exist for the enemy to move reserves and counterattack forces.

(c) In conducting a hasty defense, the enemy does not need to become decisively engaged.

(d) Enemy artillery ammo is not in short supply, and he can mass his artillery fires readily and effectively at points of his choosing.

(e) Enemy can gain air superiority in zone for short periods of time if he chooses.

(f) Elements of 14 TA are available for reinforcement of 10 CAA or counterattack within 36 hours.

(2) Weaknesses

(a) Defensive frontages compared to estimated strength have enemy positions at less than desired (doctrinal) density.

(b) Consolidations of battalions in frontline regiments leave little depth to enemy defense.

(c) Apparent commitment of all three MRRs of 15 MRD leaves only 18 MTR as the division second echelon force as well as the division counterattack force; i.e., 15 MRD defensive

positions have little depth.

(d) 10 CAA second echelon division, 33 GTD, is understrength and does not appear to be occupying a strong position defense at either the FULDA River or the HAUNE River.

(e) Positioning of reserves (second echelon) of both 15 MRD and 10 CAA will permit detection and interdiction of either reinforcement or counterattack.

(3) Vulnerabilities.

(a) 15 MRD is especially vulnerable to penetrations and exploitation on major avenues of approach into his defensive positions.

(b) Enemy reserves at division and CAA level are weak.

d. Available friendly resources.

The 16 Mech Div has the following combat and combat support forces with 85 percent systems available for employment:

(1) Maneuver forces
5 Mech Inf Bns (M2)
5 Tank Bns (M1)
3 AH Bns (AH-64)
1 Cav Sqdn (AH-1)

(2) Fire Support

6 FA Bns (155 mm)
2 FA Bns (203 mm)
1 MLRS Btry
32 CAS sorties

(3) Combat multipliers

1 ADA Bn (C/V)
1 MI Bn (CEWI)
2 Engr Cmbt Bn
1 Engr MAB Co
1 Smk Gen Co

e. Relative combat power considerations.

(1) The relative combat power between opposing forces (friendly: enemy) in the 16 Mech Div zone of operations is as follows:

Maneuver forces - 2.23:1
Artillery - 1.15:1

In and of itself this combat power is not sufficient to ensure a 50 percent probability of success in an attack across the entire

division front; however, sufficient combat power may be assigned to a maneuver brigade to penetrate successfully the current enemy defenses and subsequently to exploit the penetration. This weighting of the main effort must come at the expense of combat power in the division secondary attack and must come in terms of both maneuver forces and fire support.

(2) Course of action 1 (Avenue A)

(a) Main attack

Enemy LC	Enemy Res	Enemy Cmbt Pwr	Friendly LC	Friendly Res	Friendly Cmbt Pwr
3/47		1.13	2/72		1.61
2/47		1.13	2/73		1.90
44 HCPT (1/2)		.55	2/8		2.39
			101 AH		3.13
	4/47	1.30	102 AH		3.39
				2/7	2.43
		4.11			14.85 (3.61:1)

(b) Secondary attack

3/45		.80	2/74		1.69
1/45		.75	2/71		1.58
	4/45	1.40	173 AH		3.66
1/46		.75		2/10	2.62
2/46 (part)		.40			
	4/46	1.40			
19 AT		.60			
44 HCPT (1/2)		.55			
		6.65			9.55 (1.44:1)

(c) Reserve

1/18		1.04	2/75		1.70
2/18		1.04	2/6		2.69
3/18		1.04	2/9		2.79
211 RCN		.70	2/12		1.69
		3.82			8.87 (2.23:1)

(d) Artillery

(1) Main attack

31 ARTY		1.10	2/635		1.71
41 ARTY		1.20	2/34		1.69
42 ARTY		1.30	2/33		1.58
50 MRL		.60	2/631		1.76
		4.20	2/628		1.70
60 ARTY		1.10	16 MLRS		1.67
32 MRL		.70			
		6.00			10.11 (1.69:1)

(2) Secondary attack

43 ARTY		1.40	2/616		1.70
64 ARTY		1.00	2/32		1.61
11 MRL		.55	2/632		1.66
61 MRL		.65			
		3.60			4.97 (1.38:1)

(3) Reserve

54 ARTY		1.20			

(3) Course of Action 2 (Avenue B).

(a) Main attack

Enemy LC	Enemy Res	Enemy Cmbt Pwr	Friendly LC	Friendly Res	Friendly Cmbt Pwr	
1/45		.75	2/71		1.58	
1/46		.75	2/74		1.69	
2/46 (-)		.40	2/10		2.62	
44 HCPT (1/2)		.55	102AH		3.39	
	4/45	1.40	173AH		3.66	
	4/46	1.40		2/7	2.43	
	19AJ	.60				
		5.85			15.37	(2.63:1)
(Neutralize 4/45)		4.45				(3.45:1)

(b) Secondary attack

Enemy LC	Enemy Res	Enemy Cmbt Pwr	Friendly LC	Friendly Res	Friendly Cmbt Pwr	
3/47		1.13	2/72		1.61	
2/47		1.13	2/8		2.39	
3/45		.80	101AH		3.13	
44 HCPT (1/2)		.55		2/73	1.90	
	4/47	1.30				
		4.91			9.03	(1.84:1)

(c) Reserve

Enemy LC	Enemy Res	Enemy Cmbt Pwr	Friendly LC	Friendly Res	Friendly Cmbt Pwr	
1/18		1.04	2/75		1.70	
2/18		1.04	2/6		2.69	
3/18		1.04	2/9		2.79	
211 RCN		.70	2/12		1.69	
		3.82			8.87	(2.32:1)

(d) Artillery

(1) Main attack

Enemy	Cmbt Pwr	Friendly	Cmbt Pwr	
61 MRL	.65	2/632	1.66	
64 ARTY	1.00	3/32	1.61	
43 ARTY	1.40	2/616	1.70	
60 ARTY	1.10	2/628	1.70	
32 MRL	.70	2/631	1.76	
11 MRL	.55	16 MLRS	1.67	
	5.40		10.10	(1.87:1)

(2) Secondary attack

Enemy	Cmbt Pwr	Friendly	Cmbt Pwr	
41 ARTY	1.20	2/635	1.71	
31 ARTY	1.10	2/34	1.69	
50 MRL	.60	2/33	1.58	
42 ARTY	1.30			
	4.20		4.98	(1.19:1)

(3) Reserve

54 ARTY 1.20

(4) Conclusions. In terms of relative combat power, our numerical superiority; his depleted strength and lack of regimental second echelon forces; his placement of tank reserves in locations where interdiction and air attack can be accomplished prior to and during their commitment; and his lack of sufficient density along the line of contact allow us to concentrate our attack, to fix him in position, and to bypass some of his forces. If we employ our artillery, attack helicopters, CAS, and other combat multipliers judiciously, an attack along either avenue of approach can be successful and allow us to accomplish our mission. The choice between the two avenues of approach is both resource and terrain dependent, and war gaming the two alternatives will point up the more desirable avenue.

f. War gaming.

(1) Course of Action 1 (north).

Avenue of approach A contains maneuver space for about three battalions at the LC/LD. The terrain is forested initially for about 3-5 kilometers except in the very north along Hwy 62 and Autobahn E4/A48. The approach is dominated in the center by the KOLLENBERG (NB2520) and the AUERBERG (NB2618); however, while fixing the enemy forces in the center, these dominant positions may be bypassed on the north through EIFA (NB2422) to LINGELBACH (NB2823) and on the south in the direction SCHMARZ (NB2919)-GREBENAU (NB3321). Upon reaching PL APPALOOSA, the avenue is sufficient to accommodate a brigade attack to PL COLT and seizure of FULDA River crossing sites between NIEDERJOSSA (NB4025) and NIEDERAULA (NB4228). The FULDA River is only fordable at selected sites in this area in the event that no bridges are seized intact. Once FULDA River crossing sites are seized and expanded, engineer bridging will facilitate continuing operations. Between PL COLT and PL MUSTANG, the terrain continues to accommodate brigade-size operations, and the avenue persists at brigade size until the HAUNE River is reached. Excellent defensive terrain then dominates HAUNE River crossing sites vicinity EITRA (NB5229), and tactical crossings of the river on Avenue A can be expected to be strongly contested by the enemy. Once past the HAUNE River, however, the avenue broadens to permit ready access to the division objectives.

The urgency of the operational situation requires continuation of the attack under the corps plan to be initiated during daylight hours; however, some repositioning of our forces can take place under the cover of darkness and under the concealment afforded by early morning fog. In order to achieve a favorable combat power ratio, the division main attack in the north will be initiated by a brigade of four maneuver battalions and two attack helicopter battalions. The brigade will be supported by five artillery battalions and the divisional MLRS battery and will be given priority for available CAS sorties. An artillery preparation will be fired to both destroy enemy frontline forces and to suppress or neutralize enemy artillery fires.

A secondary attack will be conducted in the south to fix enemy forces in the vicinity of LAUTERBACH (NB2809) and to seize limited objectives east of LAUTERBACH. The brigade conducting the secondary attack will consist of three maneuver battalions and one attack helicopter battalion and will be supported by fires from three artillery battalions.

A strong reserve will be constituted and will be a brigade comprised of three maneuver battalions. This brigade will follow the brigade making the main attack and will be prepared to exploit the successes of the main attack brigade. The constitution of this division reserve is a major challenge when the main attack is conducted in the north. One frontline battalion of our division, presently committed on the division south, will not be freed to join the division reserve until the passage of lines by the 32 Armored Div. Then, at least two maneuver battalions must move laterally across the division rear to join the reserve brigade and be ready to perform the reserve mission. A solution to this challenge must be planned.

The main attack along Avenue A will encounter two MRBNs occupying dominant terrain in the center of the brigade sector unless the enemy has been destroyed or forced out of his positions during the early morning of 5 Sep. It is visualized, however, that the main attack brigade can fix the enemy forces in the center of the brigade zone and can bypass these enemy forces on the north and on the south with battalion-size forces. This two-pronged attack, if successful, will force the enemy out of his positions or have him face destruction or capture. Once past these initial enemy defenses, the main attack battalions should not expect to encounter second echelon forces but should expect a relatively strong counterattack by the enemy's 4/47 Tank Bn. The counter-attack may be against the northern battalion or the southern battalion penetration, but probably not both. Present disposition of 4/47 Tk Bn would indicate a counterattack of our attacking force in the south vicinity SCHMARZ, where our force could conceivably be drawn into a fire sack. A named area of interest is the defile vicinity NB 319173 since an avenue of approach for a counterattack by elements of the 18 MTR exists in that area.

Once the enemy first echelon defensive positions have been penetrated and our forces have reached LINGELBACH (PL APPALOOSA), the terrain opens up and facilitates friendly operations down the JOSSA River valley and early closure on the FULDA River. The avenue down the JOSSA River valley will accommodate at least two battalions abreast. A brigade secondary attack of battalion size should proceed astride Hwy 62. An important facet of Avenue A is that between PL APPALOOSA and PL COLT there is no significant avenue for use by the 18 MTR to counterattack our main attack.

At the FULDA River (PL COLT), it is anticipated that the enemy will defend strongly the crossing sites and any bridges remaining intact. This enemy defense is enhanced by the general non-fordability of the FULDA River in this area, by dominant

defensive positions from vicinity NB 4526, and by the excellent fields of fire from those positions. Unless river crossing sites can be seized early and properly expanded, a pause in the operation may become necessary at this time to bring up engineer resources and effect a river crossing.

Once across the FULDA River the advance from PL COLT to PL MUSTANG (HAUNE River) is wooded and may be defended effectively by enemy forces. At a minimum our forces can be expected to be slowed in their advance. At PL MUSTANG (HAUNE River), a river crossing situation similar to the FULDA River crossing exists. The terrain east of the HAUNE River is dominant and exhibits good fields of fire. Again, early seizure of crossing sites is critical so as to preclude the need for additional engineer resources and the conduct of a river crossing operation. If the enemy's 33 GTD has not been committed elsewhere or been moved to be used against 10 (US) Corps main attack by the 32d Armored Division, our main attack offers the enemy his best opportunity for counterattack when our forces are between PL COLT (FULDA River) and PL MUSTANG (HAUNE River) and have an exposed south flank.

With the breaching of the enemy's HAUNE River defenses, excellent avenues of approach to the division objectives exist. Assault of the division objectives will be coordinated at PL PINTO.

(2) Course of Action 2 (south)

Avenue of approach B contains maneuver space for three battalions at the present LC/LD; however, the avenue is channelized to accommodate only two battalions by the time forces reach BAD SALZSCHLIRF. At that point, also, the avenue is dominated by high ground both to the north and to the south. The avenue does offer a reasonably high speed approach down the SCHLITZ River valley. The avenue opens up quickly after a penetration of about 9 kilometers. Beyond this point and to the FULDA River (PL COLT), four or more battalions abreast may be accommodated, which may invite commitment of the reserve brigade to either expand the main attack or to undertake exploitation of the penetration.

The defended city of LAUTERBACH is considered a major obstacle and would be bypassed by the main attack in the south. If SCHLITZ (NB3913) is also defended by the enemy, it too will be considered an obstacle and will be bypassed by the main attack.

The FULDA River (PL COLT) is more easily fordable east of SCHLITZ, and crossing sites do not become as critical as they are farther north. The terrain between the FULDA River and the HAUNE River in the zone of the main attack is relatively open, is not as easily defended as the terrain to the north, and facilitates mechanized and armored operations. Once across the HAUNE River (PL MUSTANG), however, dominant terrain strongly favors the defense and guards the approaches to the division objectives. The terrain beyond the HAUNE River does, nevertheless, offer

ample maneuver space to bypass any strongly defended enemy positions.

As with course of action 1, the division attack will be initiated during daylight hours, with some of our force repositioning taking place during hours of darkness or under the concealment of early morning fog. The division main attack in the south will be initiated by a brigade of four maneuver battalions and two attack helicopter battalions. This brigade will be supported by five artillery battalions and the divisional MLRS battery and will be given priority for available CAS sorties. An artillery preparation will be fired to destroy enemy frontline forces and to suppress or neutralize enemy artillery.

A secondary attack will be conducted in the north to fix enemy forces and to seize limited objectives in zone. The brigade conducting the secondary attack will consist of three maneuver battalions and one attack helicopter battalion and will be supported by fires of three artillery battalions.

A strong reserve will be constituted and will consist of three maneuver battalions. This reserve brigade will follow the main attack brigade and will be prepared to exploit the successes of the main attack brigade. The presently committed maneuver battalions, which will not be freed up until passage of lines by the 32 Armored Div, can easily join the reserve brigade very shortly after the passage.

The main attack along Avenue B will initially engage two MRBN of the 46 MRR as well as an MRBN of the 45 MRR which is defending LAUTERBACH. The main attack should fix in position the enemy forces defending LAUTERBACH and with the major forces in the attack bypass LAUTERBACH to the south toward BAD SALZSCHLIRF and the SCHLITZ River valley. The attack will proceed slowly through the forested and hilly area north of STOCKHAUSEN (NB3101) since the enemy has not yielded that area to our attack. By the time of our attack at 051200 Sep, however, it is anticipated that the enemy will have been forced to withdraw under pressure to more defensible terrain east of the LAUDER River. A very strong defense of the high ground NW and SE of BAD SALZSCHLIRF is anticipated. The dominant terrain in that area channelizes our attack to no more than a two battalion penetration, and the enemy's fields of fire are excellent. As we approach the LAUDER River, too, we must be alert to the possibility of a limited objective counterattack by 4/46 MTBN which would take some pressure off of other 46 MRR units and allow them to occupy defensive positions east of the LAUDER River. The SODERBERG (NB3408) guards the approaches to the SCHLITZ River valley, and we can expect long range fires and a strong defense at that point.

A major effort on our part must take place vicinity of BAD SALZSCHLIRF, including artillery fires, attack helicopter strikes, and CAS. Entering the SCHLITZ River valley as rapidly as possible is critical to a penetration and later exploitation

along Avenue B. Once into the SCHLITZ River valley our avenue broadens rapidly which will allow more maneuver battalions forward in our main attack.

A short distance down the valley, however, we can expect to encounter the reserve 18 MTR of the 15 MRD. This tank regiment can be expected to either counterattack our penetration or to occupy defensive positions to block any further advance on our part. Either enemy course of action would seriously impede our advance. A counterattack would hit us when we have not yet been able to deploy more combat power forward and would probably be particularly effective against our lead battalions. On the other hand, an effective defense by the 18 MTR could cause us to deploy and move more combat power forward. This friendly posture would then invite a strong counterattack by elements of the 33 GTD which would be positioned on our immediate south flank. Our intelligence efforts must focus strongly on the 18 MTR and more especially on the 33 GTD. It is highly possible that the 33 GTD will be drawn off and repositioned to fight the 32 Armd Div attack to our south.

As our attack approaches the FULDA River, the city of SCHLITZ, if defended, poses an obstacle to our advance. Since speed of attack is essential, bypassing the city to the south will bring us immediately to the FULDA River (PL COLT). A bypass of the city to the north is a longer route but must be considered as the battle unfolds. Both bypasses may be used simultaneously to allow us to close rapidly on the FULDA River. The FULDA River in the vicinity of SCHLITZ is generally fordable with some crossing sites more advantageous than others. A major river crossing operation is not anticipated on this avenue.

Our advance east of the FULDA River toward the HAUNE River (PL MUSTANG) is terrain-favorable and will allow us to position considerable combat power forward. Once across the FULDA River, however, we are especially vulnerable to a counterattack against our south flank by all, or elements, of the 33 GTD. An MTR of the 33 GTD is presently in a position to defend the FULDA River just east of SCHLITZ and other elements of this division can be moved quickly from present positions to defend the FULDA River or to counterattack. As before, our intelligence efforts must focus strongly and effectively on the activities and movements of the 33 GTD. If the 33 GTD has been drawn off to engage 10 (US) Corps forces in the vicinity of FULDA (NB4901), a situation strongly favoring our advance along Avenue B would be created. Few good defensive positions favorable to the enemy exist between the FULDA River (PL COLT) and the HAUNE River (PL MUSTANG). On the other hand, if the 33 GTD is not drawn off and is available to defend or counterattack the penetration by our main attack, the probability of accomplishment of our division mission is dangerously low. Concomitantly, if the 33 GTD should become engaged in neutralizing the attack by the 16 Mech Div, the probability of success in accomplishing the 10 (US) Corps mission is raised considerably since the 10 CAA commander is believed to

have no other immediately available reserve to halt the advance of the 32 Armd Div to our south.

At the crossing of the FULDA River, and later the HAUNE River, the opportunity exists to commit two brigades abreast to seize and secure division objectives COYOTE, FOX, and WOLF. In order to commit two brigades abreast and to lessen the risk, the division commander should consider requesting release of the 313 Sep Mech Bde to the 16 Mech Div for employment as the division reserve until the secondary attack brigade can be disengaged and can assume the reserve mision.

East of the HAUNE River (PL MUSTANG), our advance continues along favorable terrain for about seven kilometers until we reach PL PINTO where strongly defensible terrain is encountered from the LICHTERBERG (NB5722) SE through the succession of hills to the HUBELSBERG (NB6017). Defenses on this dominant terrain are mutually supporting and possess excellent observation and fields of fire. At this point the defenders should be fixed in position by fire and maneuver, and a strong friendly force should bypass the defenses to the north and seize the division objectives.

g. Advantages and Disadvantages

Advantages and disadvantages of each course of action are enumerated as follows:

(1) Course of action 1 (north)

(a) Advantages

- Attacks overextended enemy defensive positions; little first echelon depth.
- Avoids main enemy second echelon strength of 15 MRD.
- Avoids major defended city obstacles.
- Takes advantage of well-developed LOC.

(b) Disadvantages

- Encounters narrower avenue of approach to objective.
- Is the longer route to the objective.
- Encounters major terrain obstacles at FULDA and HAUNE Rivers.
- Relies on secondary attack to fix the division second echelon 18 MTR.
- More difficult to constitute 16 Mech Div reserve from presently committed forces.

- Generates more casualties (Pers Est).

- Concentrates on division mission to possible detriment of corps mission.

(2) Course of action 2 (south)

(a) Advantages

- After initial penetration contains wider, more advantageous avenue(s) of approach to the division objectives.

- Encounters favorable opportunities to ford the FULDA and HAUNE Rivers at multiple, less defensible sites.

- Generates fewer casualties (Pers Est).

- Supported by a developed and centralized LOC coupled with a good lateral road net.

- Less difficult to constitute 16 Mech Div reserve from presently committed forces.

- Protects shoulder of corps main attack; good possibility of pinning down 10 CAA reserves.

(b) Disadvantages

- Attacks enemy where he is organized with relatively more depth.

- Encounters main enemy division and 10 CAA second echelon forces.

- Encounters major defended city obstacles of LAUTERBACH, BAD SALZSCHLIRF, and SCHLITZ; however, bypasses exist.

- Relies on secondary attack to draw off the enemy's reserve 18 MTR, an event not likely to occur.

4. COMPARISON OF COURSES OF ACTION

An analysis of the courses of action under consideration yields the significant factors shown in the comparison matrix below. The advantages and disadvantages of each course of action are assessed in comparative form and the significant factors are listed in relative order of importance.

COMPARISON MATRIX

SIGNIFICANT FACTORS	COA 1 (NORTH)	COA 2 (SOUTH)
Assists corps mission	+	+
Attacks enemy first echelon weakness	+	+
Encounters enemy reserves quickly	+	-
Encounters major obstacles	-	+
Overall avenue of approach	+	+
Retains operational flexibility	-	+
Security	-	+
Influence of secondary attack	+	-
Redisposition of friendly units	-	+
Logistically supportable	+	+
Expected casualties	-	+

Course of Action 1 has the major advantage of attacking enemy weakness without immediately encountering enemy reserves. This advantage will probably be enhanced by a successful secondary attack which will fix the enemy reserves and serve to prevent or stall an enemy counterattack. On the other hand, CA 1 attacks on a relatively narrower front; encounters the major obstacles of the FULDA and HAUNE Rivers; exhibits few opportunities for decisive commitment of the division reserve; requires time to redispose friendly forces to constitute the reserve; risks developing exposed flanks to the north and south as the penetration proceeds; and lends less favorable support of the corps main attack and overall mission accomplishment.

Course of Action 2 attacks enemy weakness but immediately suffers the major disadvantage of possibly encountering enemy division and CAA reserves along its projected avenue of advance. Defended city obstacles under CA 2 may be bypassed effectively and the fordable FULDA and HAUNE Rivers in zone are not major obstacles. Immediately upon effecting a penetration of enemy defenses, the CA 2 avenue opens up to provide significant tactical flexibility for employment of increased combat power. By attacking adjacent to the corps main attack, the south flank of CA 2 will probably be secure while the north flank security depends on the success of the division's secondary attack. CA 2 offers the major potential advantage of fixing 10 CAA reserves (33 GTD) in position or in counterattacking those reserves as they are committed against the 10 Corps main attack. This advantage significantly enhances successful

accomplishment of the corps mission.

(A decision table which portrays a subjective comparison of courses of action is presented as Enclosure A).

5. RECOMMENDATION

It is recommended that the 16 Mech Div attack at 051200 Sep with two brigades on line with the main attack in the south in the direction LAUTERBACH (NB2809)-SCHLITZ (NB3913)-BURGHAUN (NB5116) (Avenue B); seize crossings over the FULDA River; and continue the attack eastward to seize corps objective ALPHA.

APPENDIX D

DIVISION OPERATIONS ORDER

Copy ___ of ___ copies
16 Mech Div
NB174020
050200Z Sep 19___
XA 29

OPERATION ORDER 12

Reference: Map, Series M745, Germany, Sheets 5120, 5122, 5124, 5126, 5128, 5320, 5322, 5324, 5326, 5328, 5520, 5522, 5524, 5526, 5528, 5720, 5722, 5724, 5726, 5728; 1:50,000.

Time Zone Used Throughout the Order: ZULU

Task Organization:

1st Bde
- TF 2-71 Mech
- TF 2-74 Mech
- TF 2-7 Armor
- TF 2-10 Armor
- 102 AH BN (OPCON)
- 2-32 FA (DS)
- A/2-44 ADA (DS)
- A/16 Engr (DS)
- 1/A/16 MI (DS)
- 1/16 MP Co (DS)
- 1 Fwd Spt Bn (DS)

2d Bde
- TF 2-75 Mech
- TF 2-6 Armor
- TF 2-9 Armor
- B/16 Engr (DS)
- 2/16 MP Co (DS)
- 2 Fwd Spt Bn (DS)

3d Bde
- TF 2-72 Mech
- TF 2-73 Mech
- TF 2-8 Armor
- 101 AH Bn (OPCON)
- 2-34 FA BN (DS)
- B/2-44 ADA (DS)
- C/16 Engr (DS)
- 3/A/16 MI (DS)
- 3/16 MP Co (DS)
- 3 Fwd Spt Bn (DS)

16 Avn Bde
- 101 AH Bn (OPCON 3 Bde)
- 102 AH Bn (OPCON 1 Bde)

173 AH Bn
TF 2-12 CAV
16 CAC
16 AHC

16 DIVARTY
2-33 FA
16 MLRS Btry
16 TA Btry

6 FA Bde
2-616 FA (203, SP)
2-628 FA (203, SP)
2-631 FA (155, SP)
2-632 FA (155, SP)
2-635 FA (155, SP)

16 DIVTRP
2-44 ADA (-)
C/2-44 ADA
D/2-44 ADA
16 Engr (-)
D/16 Engr
E/16 Engr
5 Engr Co (MAB)
55 Engr Cmbt Bn (Corps)
16 Sig
16 MI (-)
A/16 MI (-)
B/16 MI
C/16 MI
16 MP Co (-)
16 Div Band
16 Cml Co
3 Cml Co (Smk Gen)

16 DISCOM
16 Main Spt Bn
16 AMC

1. SITUATION

a. Enemy Forces.

(1) Annex A (Intelligence).

(2) 16 Mech Div is opposed by elements of 10 CAA (15 MRD in the north with 3 MRRs in the first echelon and a tank regiment in the second echelon; 24 MRD in the south with 2 MRRs in the first echelon and one tank regiment and one MRR in the second echelon). 10 CAA second echelon (33 GTD) may be committed in a counterattack role in the 16 Mech Div sector.

(3) Enemy sortie rate is declining; however, 16 Mech Div can expect approximately 50 ground attack sorties to support enemy operations. The enemy will provide close air support using the MiG-21 and MiG-23 along with HIP and HIND helicopters.

(4) The enemy possesses a capability to deliver nuclear weapons by artillery, missile, and aircraft.

b. Friendly Forces.

(1) 10 (US) Corps attacks 051200 Sep to the east in zone to restore the Inner German Border (IGB), to destroy enemy forces, and to seize terrain objectives essential to control of the IGB; prepares to attack east into Warsaw Pact territory if ordered by SACEUR.

(2) 6 (US) Corps in the north attacks to seize and secure the IGB in sector.

(3) 32 Armd Div in the south with 203d ACR attached, attacks 051200 Sep through 12 Mech Div to seize and secure Objective Bravo; prepares to continue attack to seize objective ALPHA on order.

(5) 10 (US) Air Force continues to support 10 (US) Corps.

c. Attachments and Detachments.

(1) Task organization.

(2) The following units are attached to 16 Mech Div:

6 FA Bde
173 AH Bn
55 Engr Cmbt Bn
5 Engr MAB Co
3 Cml Co (Smk Gen)

d. Assumptions.

(1) The enemy will not initiate the use of nuclear or chemical weapons along the 10 (US) Corps front, due primarily to the proximity to his homeland and the threat of friendly retaliation. Both enemy and friendly forces possess the capability to initiate tactical nuclear warfare; however,

the enemy has not used nuclear weapons anywhere along the European front. NATO nuclear and chemical policies and release procedures are in effect.

(2) 16 Mech Div will be at approximately 85 percent strength at the time of attack.

(3) Strength and combat capability of enemy forces in zone will increase significantly with the arrival of elements of 14 TA.

(4) Friendly forces will have at least air parity and will be capable of achieving local air superiority when required.

2. MISSION

Division attacks at 051200 Sep from present line of contact in the direction LAUTERBACK (NB2809)-SCHLITZ (NB3913)-EITERFELD (NB5624); conducts crossings of the FULDA and HAUNE Rivers in zone; seizes division terrain objectives COYOTE, FOX, and WOLF; destroys enemy in zone; and consolidates positions along the Inner German Border (IGB).

3. EXECUTION

a. Commanders Intent. The intent is to penetrate the enemy's current hasty defensive positions, to move rapidly to seize successive crossings of the FULDA and HAUNE Rivers, to protect the north flank of the corps main attack, and to seize and hold the division objectives along the IGB in zone. The intent also is not to enter Warsaw Pact territory without specific orders from 10 (US) Corps.

b. Concept of Operations. Annex B (Operations Overlay).

(1) Maneuver. The operation must rapidly penetrate the first echelon defensive positions along the present line of contact. Speed of operation is essential to take advantage of current enemy weaknesses and vulnerabilities before possible reinforcement by 14 TA can take place. The attack commences at 051200 Sep with the 1st Brigade making the main attack in the south in the direction LAUTERBACH-SCHLITZ-BURGHAUN (NB5116) to seize crossings of the FULDA River east of SCHLITZ and to continue the attack to the east. 3d Bde concurrently makes a supporting attack in the north on the axis GREBENAU (NB3322)-JOSSA River valley-NIEDERJOSSA (NB4025) to fix the enemy forces in position and to seize crossings of the FULDA River in the north. 2d Bde follows the 1st Bde and, on reaching SCHLITZ, prepares to assume the mission of the 1st Bde or prepares to bypass SCHLITZ to the north, cross the FULDA River, and attack in the direction STEINBACH (NB5220)-EITERFELD (NB5624). 16 Avn Bde adds maximum support and firepower to main attack. Situation permitting, 3d Bde attacks to seize crossings of the FULDA River vicinity NIEDERJOSSA, thence eastward to seize crossings of the HAUNE River. Division deep operations will be conducted initially by DIVARTY and 16 MI Bn to locate and disrupt enemy reserve forces with priority to 4/45 MTB, 4/46 MTB, and 18 MTR.

(2) Fires. Priority of FA, AH, and CAS to the main effort.

Priority of GS fires to SEAD on commitment of helicopters; otherwise, priority of GS fires to counterfire, close support, and interdiction in order. A conventional artillery preparation will be fired against enemy first echelon defensive positions, RAGs, and DAGs. Preparation will weight the main attack and will be fired from H-20 minutes to H-hour. Priority of BAI to pinning down 18 MTR and inhibiting its movement.

(3) Counterair Operations. Priority to main CP and DISCOM. Upon seizure of crossings of FULDA and HAUNE Rivers, priority to maneuver units to protect crossing sites.

(4) Intelligence and EW.

(a) Priority of intelligence collection to locating and identifying threat nuclear delivery means, enemy battalions and larger counterattack forces (to include 33 GTD and elements of 14 TA), regimental and higher C^2 elements, and enemy artillery battalions and groups in order.

(b) Priority of jamming effort to enemy MRD C^2 nets and artillery regimental fire control nets in order. On order jamming priority shifts to identified MRD and MRR C^2 and fire direction nets capable of influencing 1st Bde operations. Priority of EW efforts to support of 1st Bde, 3d Bde, and 16 Avn Bde in order.

(5) Engineering. Priority to mobility, countermobility, and survivability of main effort. Engineer bridge support priority to main attack with particular emphasis on crossings of the FULDA and HAUNE Rivers. Annex F (Engineer).

(6) Logistical Support. Priority to main attack; i.e., priority to 1st Bde initially, to 2d Bde on commmitment, and to 3d Bde in order. Support as far forward as practicable with maximum use of continuous supply and maintenance in order to retain flexibility and momentum of the attack. Support units must be prepared for self security while sustaining forces over extended LOC distances. Priority of MSR use to reserve until committed, Class III and V movements, recovery vehicles, and medical evacuation.

(7) Deception. Division deception objective is to portray the division main attack in the north along the axis GREBENAU-JOSSA River valley-NIEDERJOSSA. This deception is designed to fix the 15 MRD mobile reserve (18 MTR) or draw it north and to delay the enemy's commitment of 4/45 MTB.

c. 1st Bde.

(1) Coordinate passage of lines of 32 Armd Div.

(2) Conduct division main attack in the direction LAUTERBACH-SCHLITZ-BURGHAUN.

(3) LD IS LC.

(4) Seize crossings of FULDA River east of SCHLITZ.

(5) On crossing PL COLT, area of operations extends to PL MUSTANG.

(6) Prepare to receive OPCON 173 AH Bn on order.

(7) Prepare to continue attack to east to seize crossings of HAUNE River in zone.

d. 3d Bde.

(1) Conduct secondary attack in the direction GREBENAU-JOSSA River valley-NIEDERJOSSA.

(2) LD IS LC.

(3) Seize crossings of FULDA River vicinity NIEDERJOSSA.

(4) On crossing PL COLT, area of operations extends to PL MUSTANG.

(5) Prepare to continue attack to east to seize crossings of the HAUNE River in zone.

e. 16th Avn Bde.

(1) Organization for combat.

101 AH Bn (OPCON 3d Bde)
102 AH Bn (OPCON 1st Bde)
TF 2-12 CAV
173 AH Bn
16 CAC
16 AHC

(2) TF 2-12 CAV

(a) Screen division north flank from PL APPALOOSA to PL MUSTANG.

(b) Maintain contact with 26 Mech Div on division north flank.

(3) Prepare to OPCON 173d AH Bn to 1st Bde on order or to 2d Bde on commitment.

(4) Priority of air movement to 1st Bde, 3d Bde, and DISCOM, in order.

f. Fire Support.

(1) Air Support.

(a) General.

1. Corps has 150 sorties daily.

2. Fifty sorties allocated to 16 Mech Div daily

3. Priority of fires to 1st Bde.

(b) Allocation of sorties for planning purposes:

1. 1st Bde: 20 sorties daily.

2. 3d Bde: 15 sorties daily.

3. Division control: 15 sorties daily.

(c) Miscellaneous.

1. Jettison unexpended ordnance into division FFA.

2. Plan two sorties per mission.

3. Appendix 1 (Air Support) to Annex C (Fire Support).

(2) Chemical.

(a) Priority for smoke to 1st Bde.

(b) Appendix 2 (Chemical Support) to Annex C (Fire Support).

(3) FA Support.

(a) General.

1. Priority of fires initially to 1st Bde; priority to division reserve on commitment.

2. Counterfire priorities, in order: nuclear capable fire systems; enemy artillery and mortars affecting main attack; multiple rocket launchers.

(b) Organization for combat.

1. DIVARTY

2-32 FA: DS 1st Bde
2-33 FA: GSR 2-32 FA
2-34 FA: DS 3d Bde
16 MLRS Btry: GS
16 TA Btry: GS

2. 6 FA Bde

616 FA (203 SP): GS
628 FA (203 SP): GS
631 FA (155 SP): GSR 2-34 FA
632 FA (155 SP): GSR 2-32 FA
635 FA (155 SP): GSR 2-32 FA

(c) Miscellaneous.

1. Priority of positions to 2-32 FA, 2-34 FA, 2-33 FA, 632 FA, and 635 FA in order.

2. During initial attack priority of GS fires is to main attack.

3. Appendix 3 (Fire Support Plan) to Annex C (Fire Support).

(4) Nuclear. Appendix 4 (Nuclear Support Plan) to Annex C (Fire Support).

(5) Coordinating Instructions.

(a) Brigade FSEs plan 20-minute preparation to begin at H-20 minutes.

(b) 10 Corps FSCL is PL MUSTANG at the initiation of the attack.

(c) Division CFL is PL COLT.

g. 2-44 ADA.

(1) Priority of protection to DISCOM and division main CP in order. Upon seizure of bridges over the FULDA River, be prepared for priority mission to protect the bridges.

(2) Organization for combat: Task organization.

(3) Annex D (Air Defense).

h. Engineer.

(1) General.

(a) Priority of engineer support initially to 1st Bde, 3d Bde, and reserve in order.

(b) Priority of engineer missions in support of attacking units to mobility, countermobility, and survivability in order.

(c) Organization for combat.

1. 16 Engr

a. A/16 Engr: DS 1st Bde.
b. B/16 Engr: DS 2d Bde.
c. C/16 Engr: DS 3d Bde..
d. D/16 Engr: GS; priority of support to DSA.
e. E/16 Engr: GS; priority of support to 3d Bde.
f. 5 Engr MAB Co: GS; priority of support to 1st Bde.

2. 55 Engr Cmbt Bn: GS; priority of support to 1st Bde and GS artillery units in order.

(d) Special instructions.

1. Maintain bridge assets forward to support mobility operations and crossings of FULDA River.

2. Be prepared to attach additional engineer assets to committed maneuver units as the situation dictates.

3. Authority to employ artillery/air-delivered mines retained at corps.

4. Annex F (Engineer).

i. 16 MI.

(1) General.

(a) ESM priority of effort will be to threat electronic communications supporting 18 MTR, 33 GTD, and other C^3 elements vicinity main attack avenue of advance, in order.

(b) Report all information on priority ESM targets to FSCOORD by most expeditious means.

(2) Annex A (Intelligence).

(3) Annex F (Electronic Warfare).

j. Chemical.

(1) 16 Cml Co: GS.

(2) 3 Cml Co (Smk Gen): GS; priority of support to main attack.

k. 16 MP Co: GS.

(1) Priority of effort to traffic control behind main attack brigade and to circulation control along MSR.

(2) Establish EPW collecting point vicinity SCHOTTEN (NA 095955).

l. Reserve: 2d Bde.

(1) Follow 1st Bde.

(2) Be prepared to assume mission of 1st Bde.

(3) Be prepared to attack to seize crossings of the FULDA River northeast of SCHLITZ and to continue the attack eastward in the direction SCHLITZ-STEINBACH-EITERFELD.

(4) Prepare to receive OPCON 173d AH Bn upon commitment.

m. Coordinating Instructions.

(1) Task organization effective 051200 Sep.

(2) PIR.

(a) Will 10 CAA conduct position defense? If so, when, where, and with what forces?

(b) Will 10 CAA counterattack? If so, when, where, and with what forces?

(c) Will the enemy reinforce 10 CAA? If so, when, where, and with what forces? Special attention to elements of 14 TA.

(d) Will the enemy employ nuclear weapons against us? If so, when, where, of what yields, and by what delivery means?

(e) Will the enemy employ chemical weapons against us? If so, when, where, what agents, and by what delivery means?

(3) No maneuver across the IGB without approval of this headquarters.

(4) Operational exposure guide: moderate risk.

(5) MOPP 2.

(6) Troop safety criteria: troops will not be exposed to greater than negligible risk to warned, exposed personnel.

(7) Annex G (Deception).

(8) Annex H (Psychological Operations).

4. SERVICE SUPPORT

Annex I (Service Support).

5. COMMAND AND SIGNAL

a. Command

(1) Div main CP located vicinity NB 174020.

(2) Div tactical CP located vicinity NB 214064.

(3) Div rear CP located vicinity NB 121970.

(4) Div alternate CP is DIVARTY CP located vicinity NB 180048.

b. Signal.

(1) Current CEOI in effect.

(2) Annex J (Communications-Electronics).

Acknowledge

SUPERSTAR
MG

OFFICIAL:

SWIFT
G3

Annexes: A -- Intelligence

B -- Operation Overlay

C -- Fire Support (omitted)

D -- Air Defense (omitted)

E -- Engineer (omitted)

F -- Electronic Warfare (omitted)

G -- Deception (omitted)

H -- Psychological Operations (omitted)

I -- Service Support (omitted)

J -- Communications-Electronics (omitted)

ANNEX A (INTELLIGENCE) TO OPERATION ORDER 12, 16 MECH DIV

Reference: Map, Series M745, Germany, Sheets 5120, 5122, 5124, 5126, 5128, 5320, 5322, 5324, 5326, 5328, 5520, 5522, 5524, 5526, 5528, 5720, 5722, 5724, 5726, 5728; 1:50,000.

Time Zone Used Throughout the Order: ZULU

1. SUMMARY OF ENEMY SITUATION

a. See situation overlay for 041800 Sep and current INTSUM.

b. Enemy opposing 16 Mech Div consists of 15 MRD and elements of 24 MRD (10 CAA). 10 CAA has the 33 GTD in reserve at the present time. The 14 Tank Army, consisting of 4 TD, 7 GTD, and 111 MRD, is the Central Front second echelon.

c. Recent movements and activities of 10 CAA indicate that the enemy will continue the hasty defense of his positions west of the Inner German Border (IGB). Movements and activities of 33 GTD create uncertainties on the employment by the 10 CAA of its reserve division. 33 GTD is in a position to move quickly to defend either the FULDA River or the HAUNE River; however, it is also well positioned to counterattack either the 16 Mech Div or the 32 Armd Div. Elements of the 14 TA are moving southwestward and are in position to reinforce the 10 CAA within 48 hours. There are no indications yet as to the enemy intentions for the employment of the 14 TA; however, proximity of the 14 TA to the 10 CAA may give the latter more freedom and latitude to employ the 33 GTD in a counterattack role.

2. INTELLIGENCE REQUIREMENTS

a. Priority Intelligence Requirements (PIR).

(1) Will 10 CAA conduct position defense? If so, when, where, and with what forces?

(2) Will 10 CAA counterattack? If so, when, where, and with what forces?

(3) Will the enemy reinforce 10 CAA? If so, when, where, and with what forces? Special attention to elements of 14 TA.

(4) Will the enemy employ nuclear weapons against us? If so, when, where, of what yields, and by what delivery means?

(5) Will the enemy employ chemical weapons against us? If so, when, where, what agents, and by what delivery means?

b. Information Requirements (IR).

(1) Are defensive positions being prepared? Where?

(2) What is the condition of crossing sites on the FULDA and HAUNE Rivers? Are crossing sites being improved or prepared for destruction?

(3) What and where are the current activities of the 33 GTD?

(4) How is artillery organized in the 33 GTD?

(5) What and where are the nuclear and chemical delivery means of the 10 CAA?

(6) Where are enemy CP's (battalion and higher) located?

(7) Where are enemy air defense assets deployed?

(8) Where and what are enemy Radio Electronic Combat (REC) assets?

(9) Where are enemy logistic stockpiles?

(10) What and when have changes in enemy communications patterns occurred?

(11) What is the focus of enemy reconnaissance?

(12) Where are, and what is the direction of movement of elements of the 14 TA?

(13) What unit movement is occuring in 10 CAA rear area?

3. INTELLIGENCE ACQUISITION TASKS

a. Orders to Subordinate and Attached Units.

(1) General.

(a) Named Areas of Interest.

1. Bridges.

FULDA River	HAUNE River
NB553457 (Hwy 27)	NB506340
NB461295	NB490338
NB433276	NB512309
NB415247	NB503277
NB413219	NB501268
NB422154	NB489212
NB432080	NB500195
	NB513169
	NB522158
	NB529108

2. Defiles.

NB423052
NB410123
NB361103

3. Transportation Networks.

NB430139 (RJ)
NB355146
NB356232
NB448189 (RJ)
NB470130 (E-W Hwy)
NB709198
NB654435 (RJ-Autobahn E70A4)
NB732326 (Hwy 62)
NB713300 (Hwy 84)
NB674337 (Hwy 62)

4. Objectives.

COYOTE (NB6737)
FOX (NB6429)
WOLF (NB6422)

(b) Common Collection Tasks.

1. Report size, location, disposition, composition, identification, and type equipment for all enemy contacts or observations.

2. Report all occurrences of enemy jamming.

3. Report all enemy helicopters flying nap-of-the-earth by DTG, location, direction, and type of aircraft.

(2) 1st Brigade. Collection priority to avenues of approach leading to LAUTERBACH-SCHLITZ.

(3) 3rd Brigade. Collection priority to avenue of approach leading to NIEDERJOSSA.

(4) 16 Avn Bde.

(a) Report DTG, location, and type of enemy air defense encountered.

(b) Report unusual activities observed with emphasis on MSR's.

(5) DIVARTY.

(a) Report ASAP all enemy artillery acquired by counterfire surveillance.

(b) FIST report size and location of all enemy troop concentrations in sector, priority to tank and motorized forces.

(6) DISCOM.

(a) Report all attempts of sabotage against supply depots, ammunition points, communications facilities, and MSR's.

(b) Report all road and bridge conditions which may affect friendly or enemy operations.

(c) Report any refugee or civilian movement which may impede present or planned operations.

(d) Report information obtained from sick and wounded refugees or EPW on enemy activities, intentions, locations, and unit identifications.

(7) 16 MI Bn.

(a) Provide one Collection and Jamming (C&J) platoon each to 1st and 3rd Brigades; maintain one platoon in GS on order to 2nd Brigade.

(b) Surveillance and collection priority to the FULDA and HAUNE River areas in sector.

(c) Report locations and movements of elements of 33 GTD.

(d) Report any evidence of river crossing site preparation.

(e) Report any evidence of defensive position preparation.

(f) Report location of identified unit CP's, battalion or higher.

(g) Report location and identification of enemy units in sector.

(8) 16 MP Co.

(a) Report enemy intelligence collection activities in sector.

(b) Report sabotage attempts in sector.

(c) Report information obtained from EPW concerning enemy activities, locations, intentions, unit identification, and strengths.

(9) 2-44 ADA Bn. Report location, type, and activity of all enemy aircraft.

(10) 16 Engr Bn.

(a) Report location, type, and size of all enemy minefields.

(b) Report location, type, and area coverage of all enemy obstacles.

(11) 6 FA Bde. Report ASAP all enemy artillery acquired by counterfire surveillance.

b. Request to Higher, Adjacent, and Cooperating Units.

(1) 10 (US) Corps is requested to provide, as obtained:

(a) Location, size, type, and direction of movement of units in 10 CAA sector beyond the HAUNE River.

(b) Location, number, and type of vehicular or air traffic outside, but in the direction of, 16 Mech Div sector.

(c) Location and type of nuclear/chemical delivery means in sector.

(d) Location and type of artillery and ADA in sector.

(e) Location of unit CP's and supply installations in sector.

(f) Movements of supplies and equipment in sector.

(2) 12 Mech Div is requested to provide, as obtained:

(a) Location of nuclear/chemical capable artillery units.

(b) Significant activities which may affect 1st Bde, 16 Mech Div on 12 Mech Div north flank.

(3) 26 Mech Div is requested to provide, as obtained:

(a) Location of nuclear/chemical capable artillery units.

(b) Significant activities which may affect 3rd Bde, 16 Mech Div on 26 Mech Div south flank.

(4) 32 Armor Div is requested to provide, as obtained:

(a) Location of nuclear/chemical capable artillery units.

(b) Significant activities which may affect 1st Bde, 16 Mech Div on 32 Armor Div north flank after H-hour.

c. Coordinating Instructions. Requests for preplanned air reconnaissance missions must be submitted prior to 1800Z daily.

4. MEASURES FOR HANDLING PERSONNEL, DOCUMENTS, AND MATERIEL

Division SOP.

5. DOCUMENTS AND/OR EQUIPMENT REQUIRED

Division SOP.

6. COUNTERINTELLIGENCE

Appendix 1 (Counterintelligence).

7. REPORTS AND DISTRIBUTION

Division SOP.

8. MISCELLANEOUS

a. Division main CP at NB174020.

b. MI Bn CP located vicinity NB179002.

c. Reconnaissance and Surveillance. Appendix 2 (Reconnaissance and Surveillance).

d. Signal Intelligence. Appendix 3 (Signal Intelligence).

e. Weather. Appendix 4 (Weather).

Acknowledge.

SUPERSTAR
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OFFICIAL
/S/ Snooper
SNOOPER
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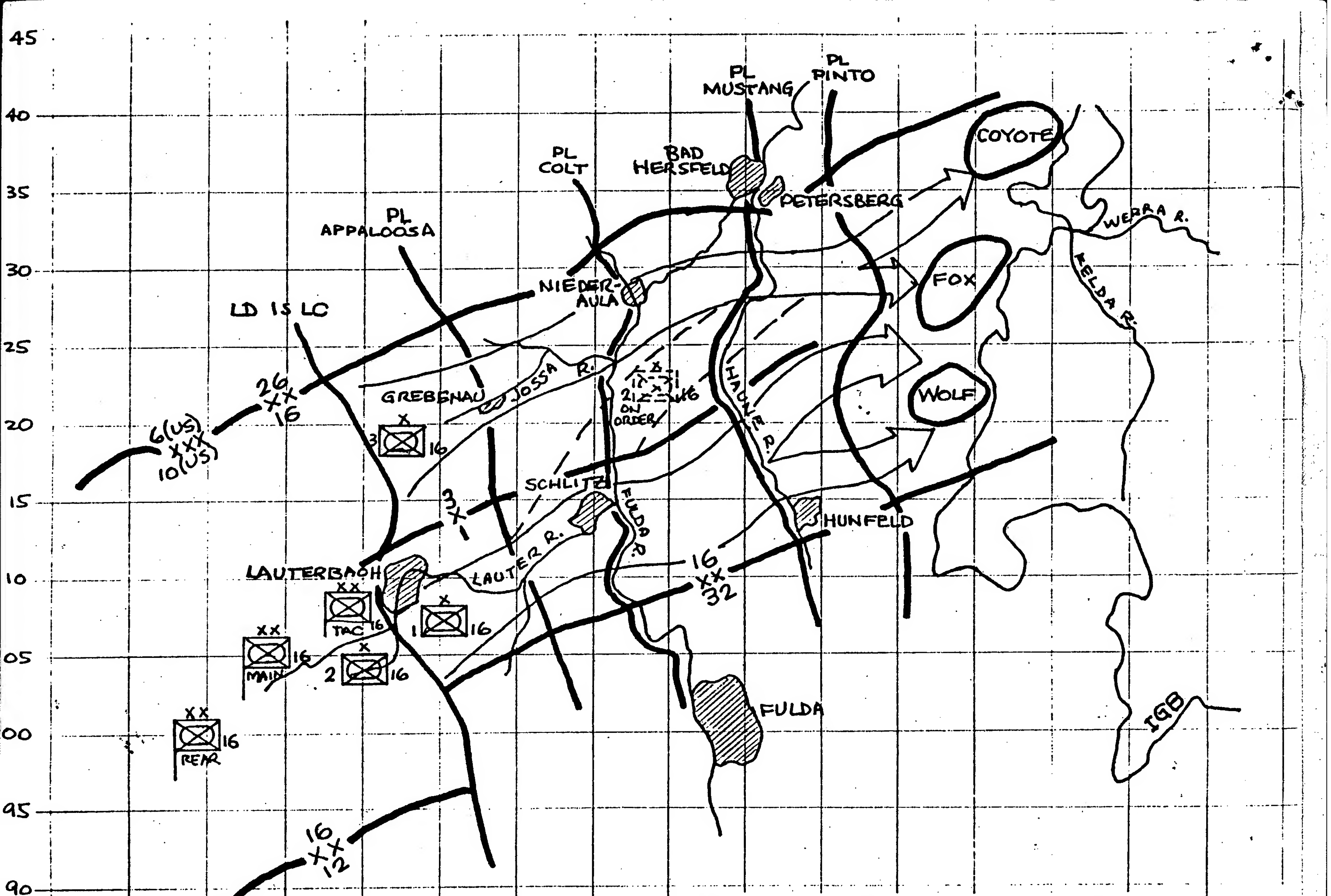
Appendixes: 1 - Counterintelligence (omitted)
2 - Reconnaissance and Surveillance (omitted)
3 - Signal Intelligence (omitted)
4 - Weather (omitted)



ANNEX B(OPERATION OVERLAY) to OPERATION ORDER 12-16th Mech Div

Reference: Map, Series M745, GERMANY, 1:50,000

Working Paper FLv 85-3

COMMAND GROUP BEHAVIORS: THEIR IDENTIFICATION, QUANTIFICATION, AND IMPACT ON COLLECTIVE OUTPUT IN AUTOMATED AND NON-AUTOMATED ENVIRONMENTS

CHARLES F. CARTER, JR., and MARCUS S. PATTON

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333

April 85

Carter PB 8163 WP FL 85-5

TECHNICAL REPORT

COMMAND GROUP BEHAVIORS: THEIR IDENTIFICATION, QUANTIFICATION, AND IMPACT ON COLLECTIVE OUTPUT IN AUTOMATED AND NON-AUTOMATED ENVIRONMENTS

ENHANCED COMMAND GROUP PERFORMANCE DATA COLLECTION, ANALYSIS, AND REDUCTION SYSTEM (CGPDARS)

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Science Applications International Corporation

8163

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ENHANCED COMMAND GROUP PERFORMANCE DATA COLLECTION, ANALYSIS, AND REDUCTION SYSTEM (CGPDARS)

Prepared For

United States Army Research Institute for The Behavioral and Social Sciences
ARI Field Unit
Fort Leavenworth, Kansas

December 1984

SAIC
Science Applications International Corporation 1200 Prospect Street, P. O. Box 2351, La Jolla, California 92038, (619) 454-3811
Albuquerque, Chicago, Dayton, Denver, Huntsville, Los Angeles, Oak Ridge, Orlando, San Diego, San Francisco, Tucson and Washington, D.C.

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SECTION 1
INTRODUCTION

1.1 PURPOSE

The contractual effort reported herein was performed to develop an enhanced capability for battalion command group performance data collection, analysis, and reduction. The development of this capability would

- Enhance the analysis and evaluation of battalion command group behavior required under the basic contract (M D A 903-81-C-0254), and

- Produce a system to provide performance feedback information to participating battalion command groups.

1.2 SCOPE

Objective observation and analysis of command group behavior will support achievement of at least two major objectives:

1- Significant improvement in the organization, doctrine, procedures, and facilities for tactical military decisionmaking.

2- Training and constructive evaluation of command groups performing tactical decisionmaking.

Meaningful analysis and evaluation of command group behavior is strongly dependent upon the identification of behavior to be observed, analyzed, and evaluated; upon the completeness and fidelity with which the identified behavior is observed and/or recorded; and upon the criteria by which the behavior will be evaluated. The scope of the present effort addresses each of these important aspects of tactical military decisionmaking. The effort is focused upon the command and staff functions rather than upon the personal attributes of each member of the command group.

The activities and results reported herein are associated with the use by the US Army of the Combined Arms Tactical Training Simulator (CATTS) in the training of battalion command groups in tactical military decisionmaking. The scope was extended during contract performance to address battalion command group exercises using the simulator MACE.

1.3 BACKGROUND

1.3.1 Related Activities

In April 1981 the US Army Research Institute for the Behavioral and Social Sciences (ARI) contracted with Science Applications International Corporation (then Science Applications, Inc.) to conduct research into command group behaviors; their identification, quantification, and impact on collective output in automated and non-automated environments.[1] In the first year of that contract it was determined that the government capability to identify, observe, and record decisionmaking behavior of battalion command groups using CATTS was deficient and that the instrumentation system for recording such behavior required enhancement if effective behavior analyses under the contract were to be performed.

In the same time period discussed above, Active Army and Army National Guard battalion command groups were being ordered to Fort Leavenworth, Kansas, at the rate of approximately two per month to undergo training using CATTS. Exercise players varied in number by battalion command group from 14 to 25, not including battalion personnel who were ordered in to cadre the controller staff. All members of each battalion staff participated actively in the training exercise from one of three separate locations (tactical operations center, jump TOC, or battalion trains), and by virtue of participation from separate locations the battalion commander and staff were not able to evaluate to any significant degree the functional performance of a single staff section or of the battalion command group as a whole. Although a post exercise debriefing of battle progress was presented to each assembled battalion command group, no evaluation or critique of group behavior or functional performance was offered. A major criticism of the training exercise by the command groups was the absence of a means by which staff performance could be evaluated, and the suggestion was made that some form of a feedback package be offered to participants. The concensus of battalion commanders appeared to rule out a formal evaluation of command group performance by CACDA which would be forwarded through command channels to the participating battalion commander. Such a formal evaluation was seen as having the potential to impact detrimentally the officer efficiency report (OER) of one or more participants, when in fact the use of CATTS was truly to support training and not to evaluate performance. In lieu of a formal evaluation, the participants suggested that they be provided with a feedback package containing information which would permit self-appraisal and evaluation.

1.3.2 Need

SAIC considered the requirements by both ARI and CACDA which would influence contract performance, including the instru-

mentation enhancement as well as the feedback package development. Those requirements are presented in the subparagraphs which follow.

1.3.2.1 Instrumentation Enhancement

Enhancement of the existing command group performance data collection, analysis, and reduction system (CGPDARS) was necessary to support both command group behavior analysis by ARI and command group performance evaluation (feedback) by participating battalion command groups. The primary requirement of such enhancement was to produce an accurate, comprehensive, and complete record of command group activities during the CATTS exercise. The media chosen for such recording were video and audio tapes, supplemented by a minimum of manual recording (indexing) of key exercise events. The enhancements desired were generally as follows:

- o Record the activities of all players in all locations of the CATTS exercise (video tapes).
- o Improve the audio recording capability for key players.
- o Develop a recording fidelity to satisfy both analytical and feedback requirements.
- o Generate time code characters on recordings to permit correlation of concurrent activities from all locations and for all recording media.
- o Provide a playback capability to support behavior analysis.
- o To the extent practicable, ensure compatibility between existing and newly acquired equipment.

1.3.2.2 Feedback Package

Development of a structure and methods for production of a "take home" performance feedback package for CATTS player groups, of necessity, included video tapes (including recorded audio tracks) of command group activities at each exercise location (i.e., battalion command post (TOC), alternate battalion command post (jump TOC), and battalion trains area). In order to properly evaluate the tapes, background information was needed as follows.

- Situation maps and overlays at selected exercise scenario times.
- Operation orders issued to, and prepared by, the battalion command group.
- Battle outcome scores.
- Suggested criteria for the evaluation of battalion command group activities.

1.4 TECHNICAL APPROACH

The technical approach selected to meet contract objectives included the following four principal tasks:

- Analyze performance data which had been recording using the existing system. The data would be analyzed to determine its quality, completeness, and acceptability for meeting requirements for behavior analysis and feedback package development. Principal products of task perfor-

mance would be identification of shortcomings and deficiencies of the current system, as well as documented behaviors suitable for analysis of selected command groups participation in CATTS exercises (Section 2).

- Develop and implement an instrumentation enhancement plan. The plan, when implemented, would overcome to the extent practicable any shortcomings and deficiencies discovered during the performance of the preceding task (Section 3).

- Specify what a performance feedback package could or should contain. The form and content of the feedback package would be included as would guidelines for production of the feedback package using the audio/visual recording system (Section 4).

- Specify how the battalion command group would use the feedback package for self-evaluation (Section 5).

- Develop a recommended audio/visual recording system to produce the feedback package (Section 6).

SECTION 2
PERFORMANCE DATA ANALYSIS

2.1 ANALYSIS OF EXISTING VIDEO AND AUDIO TAPES

Recordings of CATTS exercises which were available to SAIC for analysis of performance data are displayed in Table 2-1. The instrumentation which produced these recordings was rudimentary when compared to the later enhanced instrumentation system. The SAIC project team replayed and analyzed a significant number of the available tapes and determined that they were ill-suited for either behavior analysis or for development of a feedback package. The principal deficiencies and shortcomings in the recordings were as follows:

- Audio recordings on the existing 20-channel recorder were not adequately time-tagged to permit correlation between audio and video recordings.

- Video recordings were not time-tagged to permit correlation of concurrent activities in multiple locations.

- Audio playback of current recordings was severely limited by existing equipment in terms of quality, quantity, and accessibility to recorded information.

- There was not a sufficient number of video recorders in the CATTS facility to record all command group activity.

- Tactical display information was not video recorded.

- Standard lenses (as distinquished from wide angle lenses) on existing video cameras did not provide optimum coverage in the CATTS facility.

- Available video monitors, because of design and age, did not permit acceptable off-line observation and analysis of command group activities.

- Area microphones in the CATTS facility did not allow acceptable fidelity and ready discrimination among conversations and other communications.

- An electronic computing system was not available to support data recording, sorting, storage, retrieval and display as well as to provide computational and analytical support of research and development activities.

DRAFT

TABLE 2-1

CATTS EXERCISES

PARTICIPATION DATES	PARTICIPATING UNITS	UNIT STATUS AA	UNIT STATUS ARNG	HOME STATION
Aug 1981	1st Sqdn, 5th Cav	X		Ft Hood, TX
Sep 1981	1st Sqdn, 12th Cav	X		Ft Hood, TX
Oct 1981	4th Bn, 9th Inf	X		Ft Wainwright, AK
Oct 1981	3d Bn, 11th Inf (M)	X		Ft Polk, LA
Nov 1981	1st Bn, 28th Inf (M)	X		Ft Riley, KS
Nov 1981	1st Bn, 12th Inf (M)	X		Ft Carson, CO
Dec 1981	2d Bn, 34th Inf (M)	X		Ft Stewart, GA
Dec 1981	1st Bn, 8th Inf (M)	X		Ft Carson, CO
Jan 1982	3d Bn, 32d Armor	X		Ft Ord, CA
Feb 1982	1st Sqdn, 4th Cav	X		Ft Riley, KS
Feb 1982	4th Bn, 54th Armor	X		Ft Knox, KY
Mar 1982	1st Sqdn, 10th Cav	X		Ft Carson, CO
Mar 1982	2d Bn, 16th Inf (M)	X		Ft Riley, KS
Mar 1982	3d Bn, 70th Armor	X		Ft Polk, LA
Apr 1982	1st Bn, 504th Abn Inf	X		Ft Bragg, NC
Apr 1982	3d Bn, 17th Inf (M)	X		Ft Ord, CA
May 1982	1st Sqdn, 8th Cav	X		Ft Hood, TX
May 1982	1st Bn, 162d Inf		X	Oregon
Jun 1982	2d Sqdn, 7th Cav	X		Ft Hood, TX
Jun 1982	1st Bn, 11th Inf (M)	X		Ft Carson, CO
Aug 1982	2d Bn, 70th Armor	X		Ft Stewart, GA
Aug 1982	1st Bn, 327th Lt Inf	X		Ft Campbell, KY
Sep 1982	1st Bn, 108th Armor		X	Georgia
Sep 1982	1st Bn, 40th Armor	X		Ft Polk, LA
Oct 1982	2d Bn, 31th Inf (M)	X		Ft Ord, CA
Oct 1982	1st Bn, 195th Armor		X	Nebraska
Nov 1982	1st Bn, 149th Inf (M)		X	Kentucky

AA - Active Army
ARNG - Army National Guard

The deficiencies and shortcomings resulted in a situation where little useful information for behavior analysis purposes could be derived from information recorded on the existing video and audio tapes. It was then decided that ten CATTS exercises integral to ARI's Training Development Study (TDS) would be recorded using an enhanced instrumentation system and used to produce data for command group behavior analysis. The TDS design called for five battalion command groups each to conduct two training exercises which would produce the required data. The participating battalion command groups are identified in Table 2-2, and all were Active Army units.

TABLE 2-2
CATTS TDS EXERCISES

PARTICIPATION DATES	PARTICIPATING UNITS	HOME STATION
Dec 1982	5th Bn, 33d Armor	Ft Knox, KY
Jan 1983	3d Bn, 10th Inf (M)	Ft Polk, LA
Jan 1983	1st Bn, 77th Armor	Ft Carson, CO
Feb 1983	4th Bn, 68th Armor	Ft Bragg, NC
Mar 1983	2d Bn, 19th Inf (M)	Ft Stewart, GA

Prior to the start of the TDS exercises, the instrumentation enhancement plan (Section 3 below) had been developed, approved, and implemented.

2.2 TDS DATA COLLECTION AND REDUCTION

Battalion command group activities integral to ARI's Training Development Study were recorded on video and audio tapes using the enhanced instrumentation system discussed in Section 3.

Once the activities were duly recorded, the next subtask was to extract from the recordings those data which would be useful both for behavior analysis and for feedback package development.

SAIC had previously developed a methodology for analyzing command group behavior. A protocol to extract (collect) data from the video and audio tapes and to reduce the data to usable form to support the analytical methodology was then evolved. In order to review the tapes of the various exercises and to identify and classify the command group activities, a group of three well-qualified and military-experienced consultants was assembled (see Appendix C for resumes of consultants selected). A training period for the consultants ensued in order to familiarize them with the data extraction protocol and with the video and audio playback equipment to be used in viewing the recorded information. Each consultant, independent of the others, then identified and classified command group activities of the TDS exercises. Essentially, the activity of each command group member at each command post location was observed, classified, and recorded in order to permit analysis of the contribution of each to overall command group performance. Once all of the performance data relating to each simulation exercise were classified and recorded, the data were entered into an automated data base and were verified for accuracy and completeness. Finally, the data were reduced to support behavior analysis by SAIC and ARI in accordance with the methodology previously developed, and the reduced data in printout form were delivered to ARI.

SECTION 3
INSTRUMENTATION ENHANCEMENT PLAN
DEVELOPMENT AND IMPLEMENTATION

3.1 PLAN DEVELOPMENT

The results and findings from the analysis of performance data revealed instrumentation deficiencies to be overcome if acceptable behavior data were to be collected for measurement and feedback. To overcome the deficiencies SAIC prepared a CATTS Instrumentation Enhancement Plan (Appendix D). Advice regarding instrumentation capabilities, equipment state of the art, and system design was provided by SAIC technical personnel as well as by the following electronic equipment manufacturers and vendors:

Centrex Audio Visual Systems, Inc.
210 West 6th Street
Topeka, KS 66603

Chrono-Log Corporation
2 West Park Road
Havertown, PA 19083

Electronic Contracting Company
3061-63 Merriam Drive
Kansas City, KS 66106

Magnasync/Moviola Corporation
5539 Riverton Avenue
North Hollywood, CA 91601

Video Masters, Inc.
1616 Broadway
Kansas City, MO 64141

The CATTS Instrumentation Enhancement Plan served as the basic document for the acquisition and installaton of equipment.

3.2 EQUIPMENT ACQUISITION AND INSTALLATION

In keeping with the enhancement plan, and within available resources, SAIC purchased and installed the planned items, integrated them with the existing system, and achieved a complete data collection package. The equipment was installed in Rucker Hall (Bldg 50), Fort Leavenworth, KS and in SAIC facilities, 424 Delaware Street, Leavenworth, KS. The enhanced video and audio systems installed in Rucker Hall are shown in Figures 3-1 (video) and 3-2 (audio) respectively. The observer (playback) stations installed in SAIC facilities in Leavenworth are shown in Figure 3-3. The equipments acquired are identified in Appendix E.

Several equipment items included in the instrumentation enhancement plan were later determined not to be needed or not cost-effective and, therefore, were not purchased. They are

- The color video camera system together with its associated video recorder. The resources for contract performance were insufficient to accommodate the purchase these items, and the need did not justify additional resources.

- The video editor system, including technician labor, exceeded contract resources. Additionally, the government chose not to change existing tables of distribution to provide the editor technician.

- One of two cordless microphone systems. Experimentation with one microphone system was directed before the second system would be purchased.

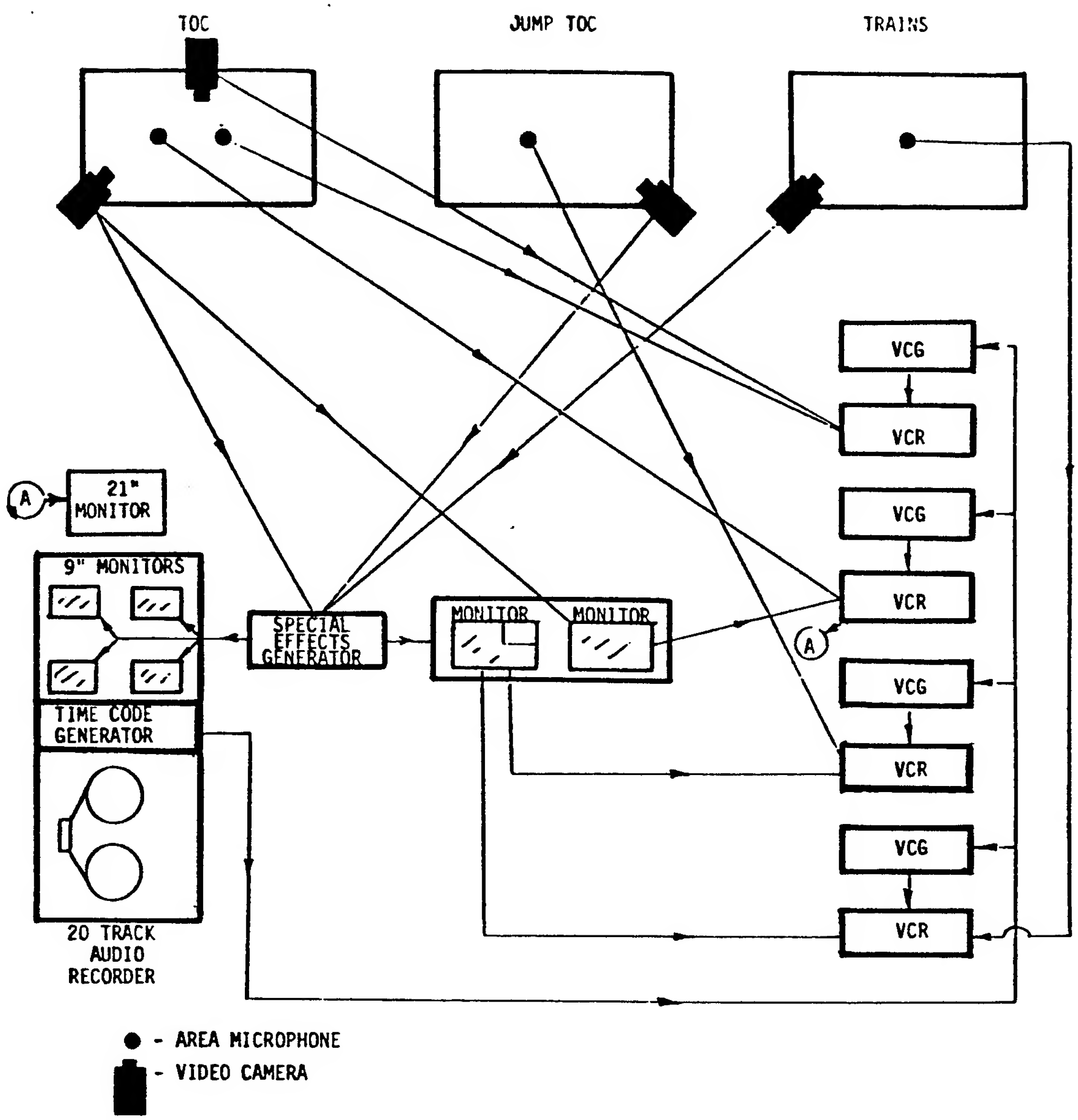

Figure 3-1. CATTS INSTRUMENTATION-VIDEO

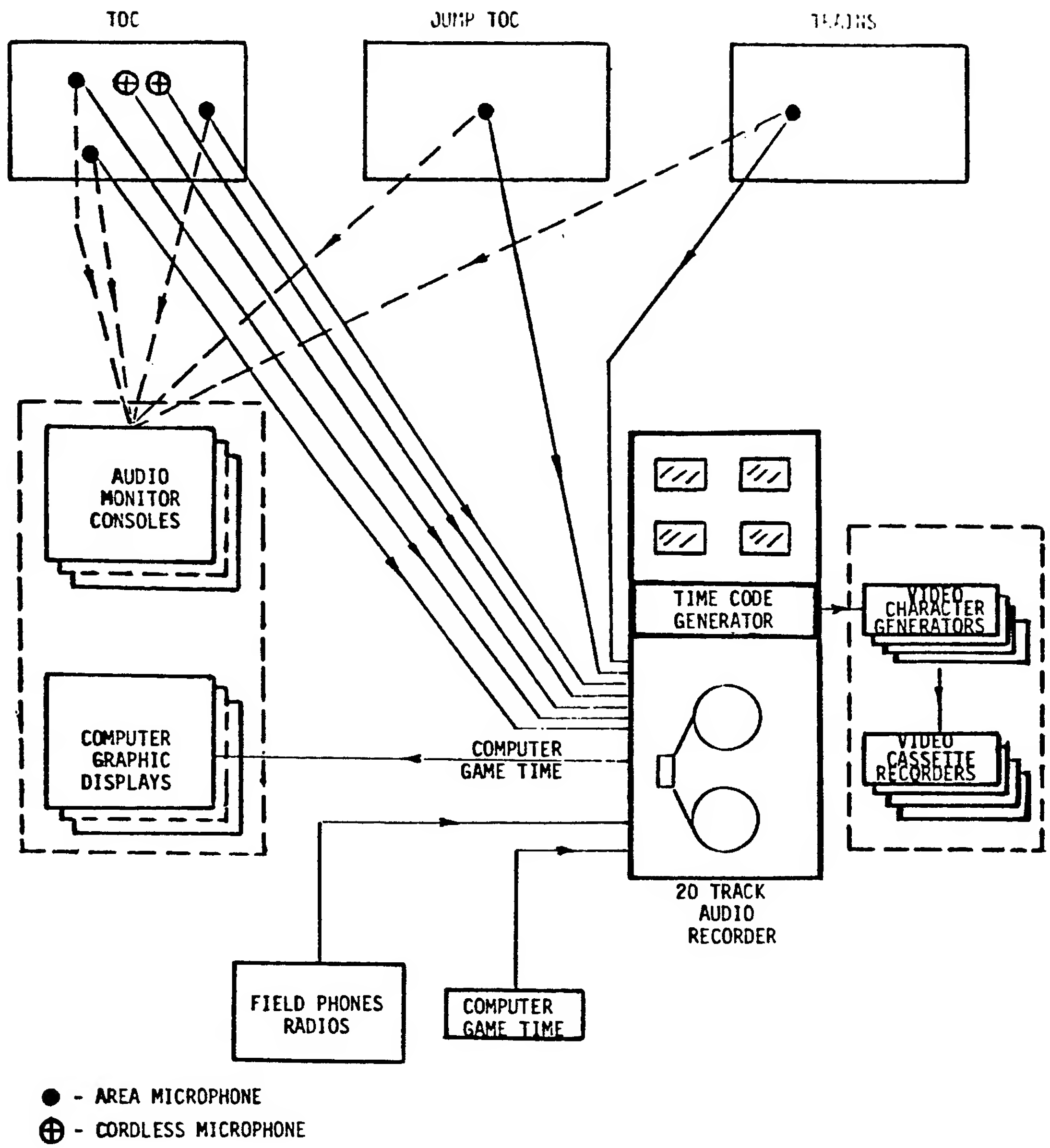

Figure 3-2. CATTS INSTRUMENTATION-AUDIO

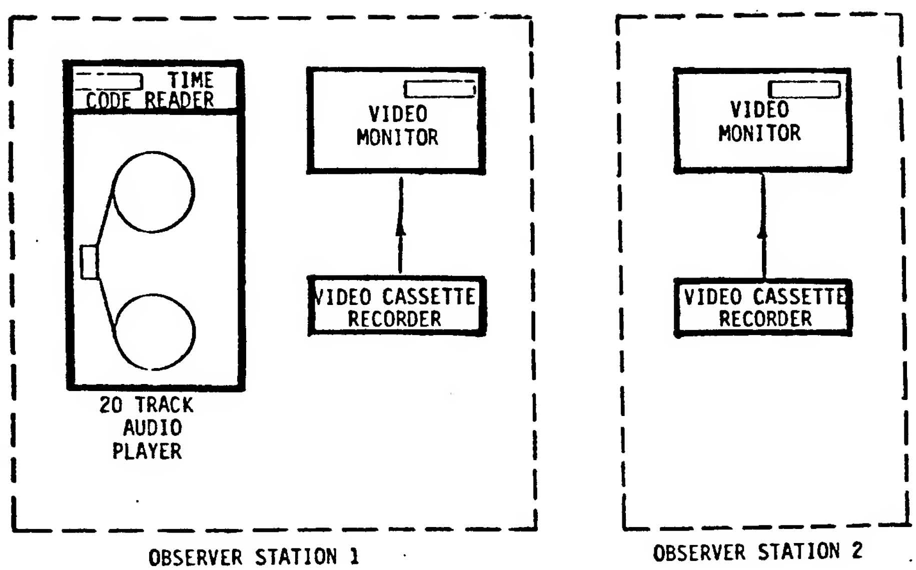

Figure 3-3. ARI/SAIC OBSERVER STATIONS

3.3 COMBINED ARMS TACTICAL TRAINING SIMULATOR (CATTS)

A complete discussion of CATTS is contained in Appendix C to Reference 2 (see paragraph 7 below). Extracted from that appendix for ease of consideration in this report are diagrams showing exercise activity and equipment installation, which are described below.

3.3.1 CATTS Controller Room

A schematic of the CATTS Controller Room is shown in Figure 3-4. Activities and behavior were monitored at the ARI/SAI monitor/record station through the use of four 9" television monitors and headsets. Video cassette recorders (4), video character generators (4), time code generator, and feedback controller were installed in this location. The receiver for the cordless microphone was also installed at this location.

3.3.2 Tactical Operations Center (TOC)

A schematic of the CATTS TOC is shown in Figure 3-5. Principal command, operations, and intelligence staff activities were recorded from this location. Area microphones were carefully positioned in the TOC to permit recording of key conversations, and wide angle lenses were installed on government video cameras. The cordless microphone and transmitter were affixed to the battalion commander. This microphone system permitted high fidelity recording of conversations between the battalion commander and other staff members whether the commander was in the TOC or jump TOC.

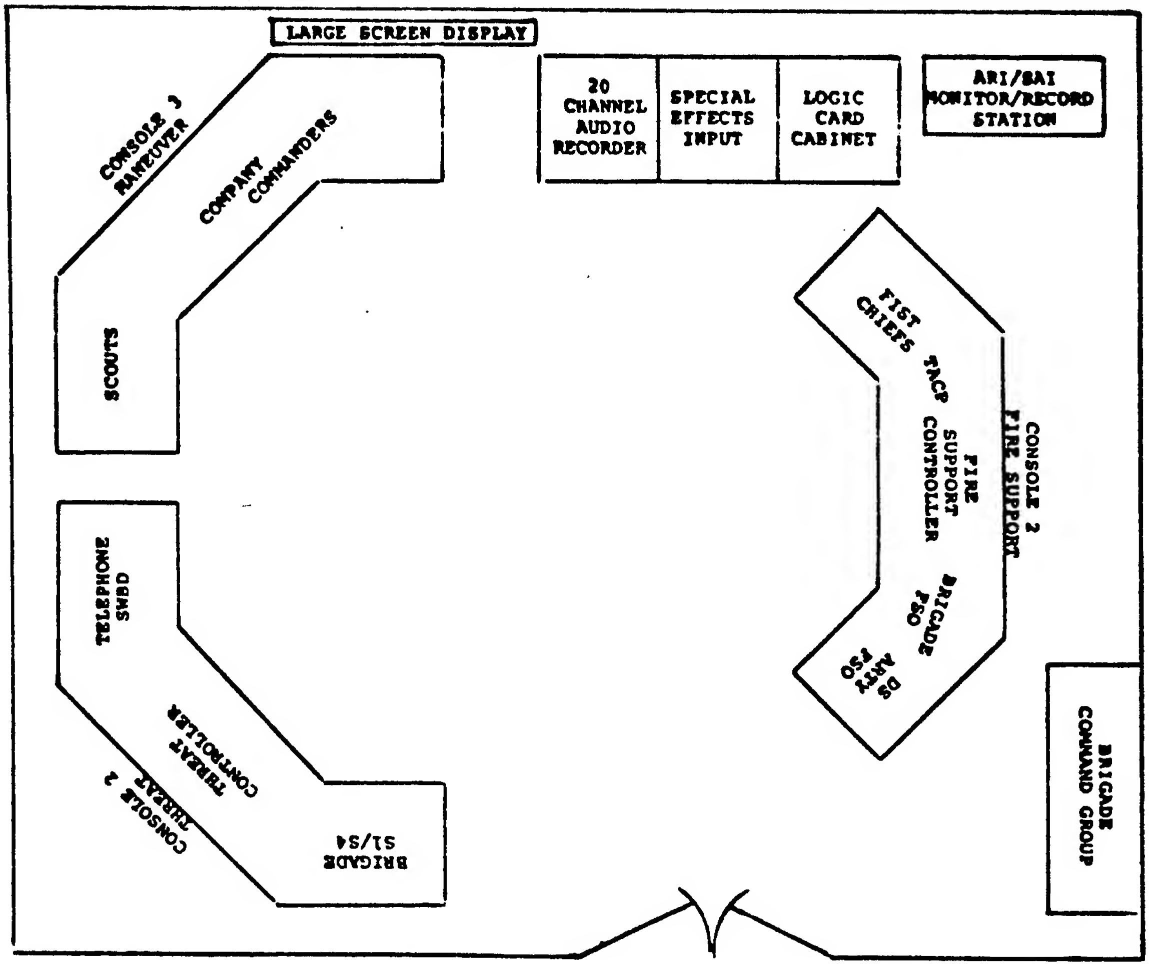

Figure 3-4. CATTS CONTROLLER ROOM

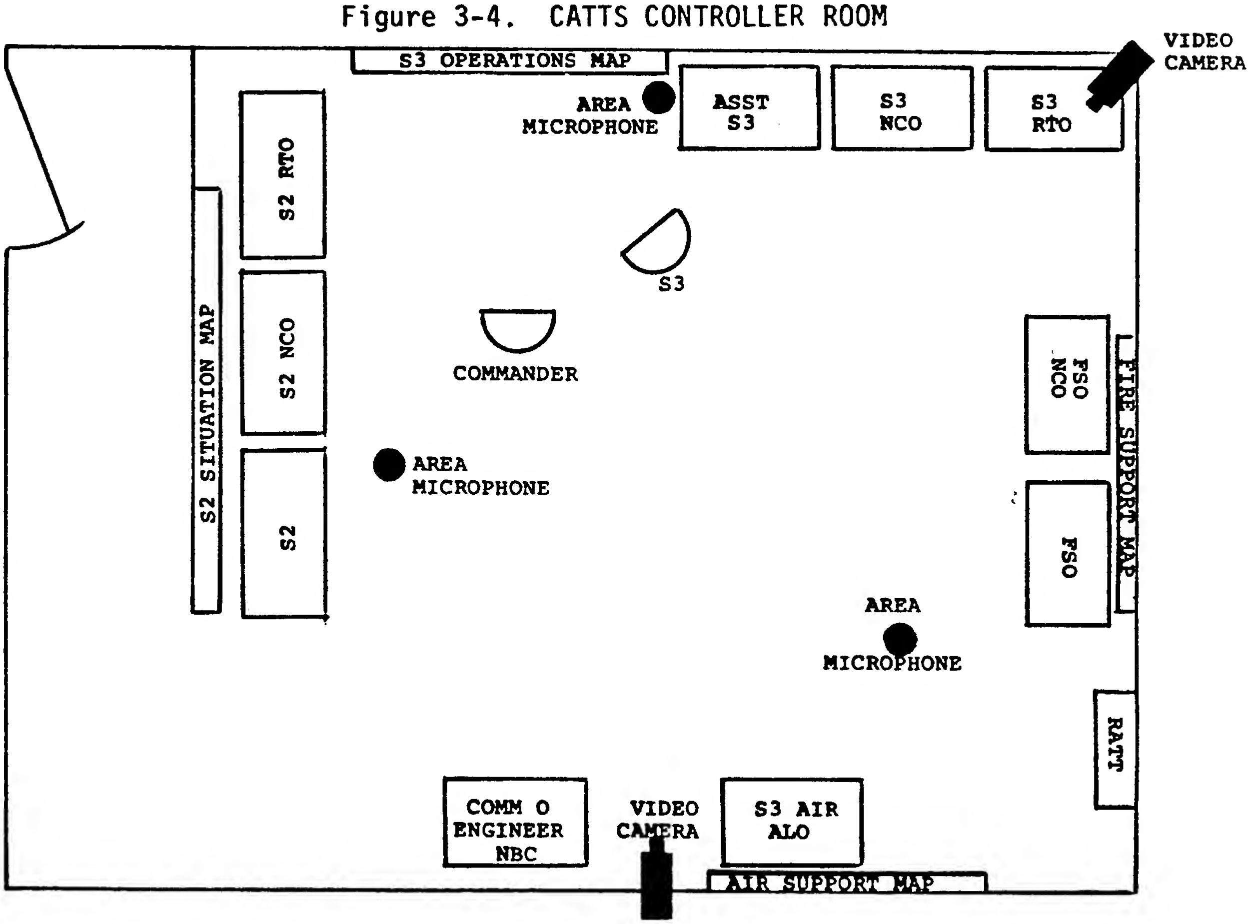

Figure 3-5. TACTICAL OPERATIONS CENTER

3.3.3 Forward Command Post (Jump TOC)

A schematic of the forward command post is shown in Figure 3-6. Command activities were recorded from this location at any time that the commander or a key staff officer (e.g.,S3) chose to occupy this simulated position. An area microphone was carefully positioned in this location, and a wide angle lens was installed on the government video camera.

3.3.4 Battalion Trains

A schematic of the battalion trains area is shown in Figure 3-7. Administrative and logistic staff activities were recorded from this location. An area microphone was carefully positioned in this location, and a wide angle lens was installed on the government video camera.

3.3.5 Observer Stations

Two observer stations were established in the SAIC facility in Leavenworth, KS to permit playback of audio and video recordings for behavior classification. Military consultants and ARI staff members performed their analytical tasks at these stations. The 20-channel audio reproducer, time code reader, video cassette recorders (2), and video monitors (2) were installed at these stations. The schematic configuration of the equipment is shown in Figure 3-3.

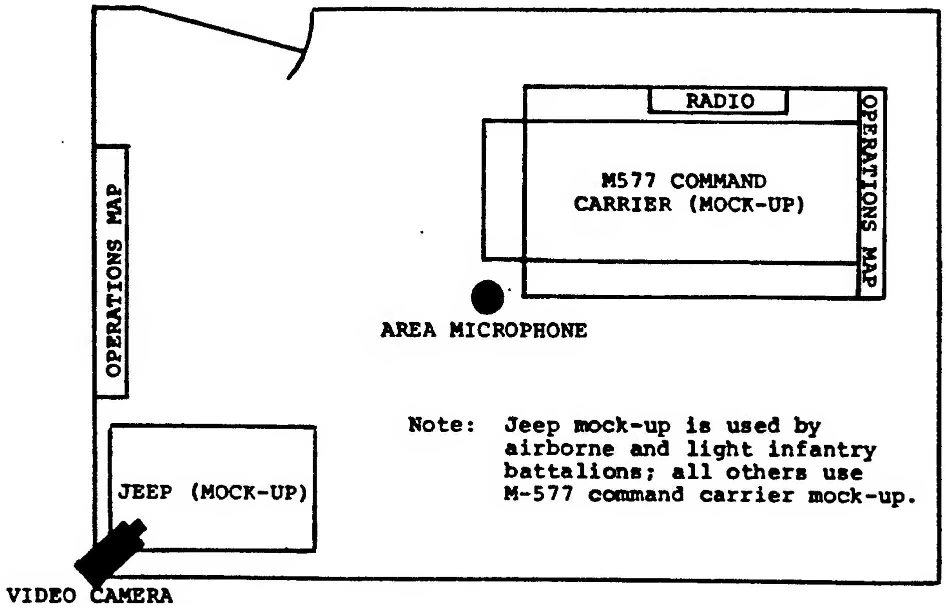

Figure 3-6. FORWARD COMMAND POST (JUMP TOC)

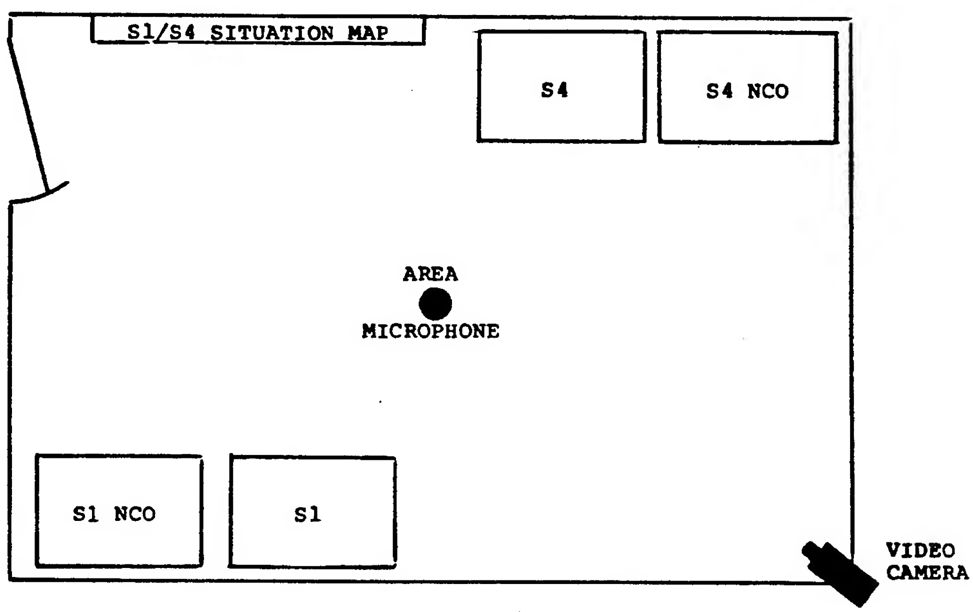

Figure 3-7. BATTALION TRAINS

SECTION 4
FEEDBACK PACKAGE DEFINITION

4.1 FEEDBACK PACKAGE GUIDELINES

The development of a feedback package to be used for evaluation of battalion command group performance required research into doctrinal and training literature available from the US Army. For the battalion, the literature consisted primarily of FM 71-2, The Tank and Mechanized Infantry Battalion Task Force; ARTEP 71-2, Battalion/Task Force Command Group and Staff; and FM 101-5, Staff Organization and Operations. Additional field manuals and Army training and evaluation programs which had doctrinal impact on battalion task force operations were also researched and proved useful in placing battalion command group activities in proper perspective.

Interviews were conducted with Active Army personnel who operated the Combined Arms Tactical Training Simulator to identify feedback package components which would be useful to battalion command groups in self-evaluation their exercise performance. Similar interviews were conducted with Active Army personnel assigned to develop the computer-supported training simulation, MACE. Finally, retired military personnel available in the Leavenworth, Kansas community were interviewed for their personal views on the evaluation of battalion command group performance.

The feedback package components defined in this section reflect Army doctrine and procedures as well as the consensus of those personnel interviewed. The factors discussed in paragraph 4.2 below precluded any significant feedback which might have been derived from battalion command groups actually participating in the training exercises.

4.2 FACTORS AFFECTING FEEDBACK PACKAGE DEFINITION

During the ARI-sponsored Training Development Study (TDS), ARI and SAIC were permitted to conduct formal and informal interviews of participants, and the results of these interviews served to assist feedback package component definition. It was then determined, however, that with the completion of the TDS exercises, CATTS would no longer be used to train battalion command groups in tactical decisionmaking, and that future battalion command group training exercises would be conducted using the Army training simulation MACE.

With the demise of CATTS as a training simulation and with the anticipated use of MACE, the focus of effort was shifted to the development of a MACE feedback package. Concurrent with this shift, the government negotiated a separate contract for the design of an instrumentation system for MACE and assumed responsibility for the procurement of instrumentation equipment in accordance with the approved system design. Development of the MACE feedback package was strongly dependent upon the capability for recording, and otherwise gathering supporting data from, the MACE training exercises.

4.3 FEEDBACK PACKAGE COMPONENTS

Coordination meetings with key government personnel involved in the development of MACE training simulation were initiated in May 1983 in order to define the feedback package components. Much of the definition of the feedback package content and format was to be based upon its similarity with CATTS. SAIC requested and organized a series of coordination meetings with ARI and key CACDA personnel involved in MACE development. These meetings produced initial guidelines for a feedback package to be

composed of video tape recordings, each tape with two audio channels; periodic recording on the video tape of battle simulation displays; operations orders, maps, and overlays; computer-calculated battle outcome scores; and, when prearranged, limited but specific evaluation of battalion command group performance.

Based upon the guidelines, SAIC developed options for various combinations of feedback package components, and these options are presented in Table 4-1. These package components and options were presented to MACE project personnel on 23 June 1983 (Appendix G), and a tentative selection of options was made (see Table 4-1). Package components selected are discussed in the subparagraphs below.

4.3.1 Video Tapes

The video tapes, together with their recorded audio tracks, are the most important component of the take home performance feedback package. The tapes are the medium by which the battalion command group can view their actual performance during the training exercise.

Video cameras with wide angle lenses will provide optimum single camera coverage of the activities in each of the command post locations; namely, the tactical operations center (TOC), jump TOC, and battalion trains. A single video tape recording of activities in each location will be produced, although a second video tape in the TOC may be recorded using equipment now available. The video tapes will display an exercise time-code (day/hour/minute/second) which will permit relating group activities to the time-sequenced tactical scenario as well as permit correlation of concurrent activities occurring in the separate command post locations. The audio track on the video tape will be used to record audible conversations occurring

TABLE 4-1. FEEDBACK PACKAGE COMPONENT OPTIONS

FEEDBACK PACKAGE COMPONENT / OPTION	1	2	3	4	5
VIDEO TAPES	MACE record all or portion of exercise. MACE deliver unedited tapes.	Same as Option 1	Same as Option 1	Same as Option 1	Same as Option 1
BATTLE SITUATION	MACE deliver computer printouts of exercise begin and end personnel and equipment status and dispositions.	Same as Option 1 plus MACE deliver hourly situation reports of strengths and video-recorded force dispositions.	Same as Option 2	Same as Option 2	Same as Option 2
MAPS AND OVERLAYS	MACE supply terrain maps and brigade overlays. Bn cmd gp prepare and retain battalion overlays.	Same as Option 1	Same as Option 1	Same as Option 1	Same as Option 1
OPERATION ORDERS	MACE supply written bde op o. Bn cmd gp prepare and retain Bn op o. Video tape includes battalion orders.	Same as Option 1	Same as Option 1	Same as Option 1	Same as Option 1
BATTLE OUTCOME	MACE supply written instructions for calculating LER/RER. Bn co makes calculations assisted by MACE.	Same as Option 1 except MACE make calculations and compare with scores of similar units.	Same as Option 2	Same as Option 2	Same as Option 2
EVALUATION	None by MACE	MACE provide written suggested guide for battalion self-evaluation of performance.	MACE evaluate command group performance keyed to time-coded video tapes.	Same as Option 3 plus MACE prepare standard OESO evaluation of unit performance.	Same as Option 4 plus MACE prepare detailed written evaluation of performance of each staff section.
SUPPLIES	MACE: None Unit: Video tapes up to 24-3/4" or 6-½".	Same as Option 1	Same as Option 1. MACE supply tapes for evaluation if not provided by battalion commander.	Same as Option 3	Same as Option 3.

SELECTED OPTIONS

in each command post location. The area microphones, however, pick up only the audible sounds emanating in the command post location and do not record both ends of the two-way conversations between the exercise controllers and the battalion command group. (Note: The enhanced system records all two-way conversations on audio tape; however, the audio tape is not a component of the feedback package). Separate video tapes will be produced for the operation planning and for the execution phase of each exercise. The feedback package for a single exercise, will therefore, include six video cassettes (or eight cassettes if the second TOC camera is activated).

Playback of the 1/2-inch video tapes by the battalion command group will require a compatible video cassette player and monitor from the post, camp, or station media center supporting the battalion. A remote control for the video cassette recorder/player is desirable but not mandatory.

4.3.2 Battle Situation Reports

Battle situation reports will be prepared by exercise controllers as hard copy reports. The reports will be prepared for the beginning and end of the exercise and not less frequently than hourly during the exercise. These reports will consist of computer-generated printouts of the following:

- Dispositions of opposing forces by UTM coordinates

- Status of personnel, major equipment items, ammunition, and POL of opposing forces

4.3.3 Maps and Overlays

A terrain map (1:50,000) of the tactical area of operations will be included in the feedback package as will operations overlays of force dispositions, control measures, and significant activities for the beginning and end of the exercise. Friendly as well as enemy information will be included. Resources permitting, the controller staff will prepare operation overlays reflecting dispositions of opposing forces corresponding the battle situation report for each exercise time period (paragraph 4.3.2 above). These overlays will reflect actual force dispositions (ground truth).

Overlays prepared by the battalion command group for delivery to the brigade staff or to company commanders will be retained by the controller staff, and copies will be included in the feedback package. Overlays prepared for intra-command group use must be retained by the participating command group and will represent the situation as perceived by the group.

4.3.4 Operation Orders

Brigade operation orders (complete or fragmentary) will be prepared by the controller stfaf in written form for delivery to the battalion command group. These orders will contain the essential mission and situation information needed by the battalion command group to conduct the training exercise. The brigade order will include the situation, mission, assignment of tasks to brigade units, and the support and assistance to be provided to the battalion. It will contain the detail that is necessary for the battalion command group to issue the battalion operation order. A copy of the brigade operation order, together with an accompanying operating overlay, will be included in the feedback package.

Battalion operation orders will normally be issued orally and will be documented on the video tape of the exercise planning phase. No additional documentation of the battalion operation order will be included in the feedback package. Any operation overlay prepared by the battalion to accompany the oral order will be preserved by the participating battalion command group for later evaluation of exercise performance.

4.3.5 Battle Outcome Reports

The Combined Arms Tactical Training Simulator (CATTS) uses a dynamic force interaction simulation to make battle assessments and to produce battle outcome results. Other training simulators use similar techniques to measure battle results. As one measure of battle outcome, CATTS calculates a loss exchange ratio (LER) which is the quotient of Red losses divided by Blue losses and is a measure of Blue effectiveness taking into account both Blue's capability of inflicting losses and capability of surviving Red actions. CATTS also calculates a relative loss exchange ratio (RER) which is the quotient of the proportion of Red losses divided by the proportion of Blue losses. The RER is a measure of Blue effectiveness taking two major factors into consideration; first, the numerator is an indicator of Blue destructive capability and, second, the denominator is an indicator of Blue survivability. The combination approaches an overall indication of Blue combat effectiveness.

Battle outcome scores (LER and RER) will be computer-generated and will be included in the feedback package. Also to be included will be the spectrum of battle outcome scores achieved by all participating command groups to date, ranging from poor to excellent. The scores will enable the battalion command group to assess how successful his command group was in mission performance relative to the performance of other battalion command groups.

4.3.6 Staff Performance Evaluation Scoresheets

The feedback package will contain written scoresheets for battalion self-evaluation of staff section performance. The scoresheets may be completed selectively or totally in conjunction with a viewing of the exercise performance recorded on video tapes. Scoresheets for self-evaluation of the battalion task force commander and for each coordinating staff section are contained in Appendix F.

4.4 FEEDBACK PACKAGE PRODUCTION

Feedback package production will be accomplished by the CATTS/MACE training cadre in accordance with the guidelines addressed in the subparagraphs below.

4.4.1 General

The development of a feedback package demands the assignment of training exercise supervisory personnel to the specific task of preparing the package. The task should be assigned to one or more persons as a primary duty and should not be a secondary duty assignment for exercise controller personnel.

The objective of producing a take home feedback package envisions that the package would be delivered to the participating battalion command group prior to its departure from Fort Leavenworth for return to its home station. Many components of the feedback package can meet this criteria; however, several of the components cannot meet the criteria (e.g., the video tapes). A timeline for transmission of the feedback package by commercial carrier (Federal Express, Emery, Airborne) should not exceed 72

hours. Meeting this timeline will permit self-evaluation of exercise performance while the exercise is still fresh in the minds of the participants.

4.4.2 Pre-Exercise Activities

Materials for the conduct of the training exercise are prepared in advance by exercise supervisory personnel and controllers. Selected materials from those prepared will be extracted for inclusion in the feedback package and consist of the following:

- Terrain maps of the tactical area of operations
- Brigade operation order and accompanying operation overlay
- Battle situation reports for the beginning of the exercise
- Instructions for interpretation of LER and RER, together with spectrum of previous battle outcome scores
- Staff performance evaluation guides
- Index of significant activities to be included in the training exercise scenario

Immediately prior to the start of the exercise personnel assigned to feedback package preparation will ensure that all instrumentation equipment is operational and, where necessary, is pre-set to perform the recording function. Such activities include

- o Video cameras are operating and are optimally positioned to view the exercise areas

- o Area microphones are operational and are recording on the audio track on the VCR

- o Cordless microphones are physically attached to key command group personnel and are operational

- o Video cassette recorders are operational and are loaded with blank cassettes. Blank video cassettes are immediately available for reload.

- o Control room video monitors are operational

- o Time code generators (video and audio) are set to exercise time

- o Audio recorder is operational

4.4.3 Exercise Activities

Personnel assigned to prepare the feedback package will perform the following activities in connection with the preparation of the package:

- o Observe exercise performance at all CP locations using the 9" TV monitors in the controller room (or audio/visual center). Significant activities taking place in

each location may be integrated into the written record discussed immediately below to assist the battalion command group in performance evaluation.

- Maintain a written chronological record (log) of key exercise events during both the planning and execution phases. This log must include all significant exercise information introduced to exercise play keyed to its time of entry. The log will permit the battalion com mand group to view the video tapes and to relate video recorded staff actions to the introduction of specific scenario information.

- Specify to the supporting data processing facility the time for generating battle situation reports; verify that the reports have been generated; initiate preparation of operation overlays based upon computer-generated force disposition information.

4.4.4 Post Exercise Activities

The final components of the performance feedback package will be prepared and the package assembled as soon as practicable after the training exercise is terminated. The feedback package activities conducted in the post exercise period are

- Complete the video taping, including any critique of exercise performance presented by training exercise supervisory personnel; prepare duplicate video tapes to be included in the feedback package since the originals will be retained by ARI for behavior analysis; label and package the video tapes.

- Complete the chronological log of key events and duplicate the log for inclusion in the feedback package. The original log will be retained by ARI for behavior analysis.

- Collect from the data processing facility and package all battle situation reports.

- Prepare operation overlays for each exercise time period in the execution phase.

- Collect from the data processing facility, and prepare written interpretation of, battle outcome scores (LER and RER) for the training exercise.

- Assemble the feedback package for delivery to the battalion command group; transmit the package not later than 72 hours after completion of the exercise.

SECTION 5

PERFORMANCE SELF-EVALUATION

5.1 EVALUATION OBJECTIVES

Battalion command group performance in CATTS/MACE training exercises may be evaluated to meet a variety of objectives. CATTS was designed as a tool for the training of battalion command groups in military decisionmaking, and the simulation of tactical operations (force interactions) is dynamic and realistic. Give the initial tactical scenario and a mission, the battalion commander (supported by other numbers of the battalion staff) makes a decision and issues orders for the initiation of battalion task force operations, and from that point the training exercise becomes dynamic. Progressive scenario changes are introduced as the tactical battle is fought, and the battalion command group is challenged to react to these situational changes and to make decisions which will permit achievement of the originally assigned tactical mission. The training exercise is performed until a tactical mission is completed or until terminated by controller personnel, usually the latter. The battalion command group may perform evaluations of their exercise performance given appropriate feedback information, and those evaluations may address one or more of the following subjective areas:

- Evaluation of the quality of the decisions made, given the substance and timing of the introduction of scenario information

- Evaluation of the efficiency of performance of the battalion task force commander and each coordinating staff section in collecting, processing, and using available information

- Evaluation of battalion procedure guides (e.g., standing operating procedures) for the performance of command post operations

Each of these evaluations is discussed in the subparagraphs which follow.

5.2 EVALUATION OF DECISION QUALITY

The responsibility for military decisionmaking at any echelon rests solely on the shoulders of the commander. The evaluation of decision quality, therefore is a reflection of the application of sound military doctrine by the commander, given the timing and substance of information available to him. His decision may, however, be influenced by recommendations from his principal staff officers and other advisors.

Evaluation of decision quality will be made in hindsight based on the battalion command group review of the progress of the battle as influenced by the decisions made. The evaluatin must be subjective since the battle cannot be rerun based upon changes in decisions.

5.2.1 Operation Order

Evaluation of the operation order for quality and substance should be made using the following aids:

- The brigade operation order and accompanying operation overlays, together with any oral information presented by the brigade staff (controllers). The latter information may be retrieved from the video tape of the planning phase.

- Battle situation reports for (1) the start of the exercise, which will reveal opposing force dispositions and status that influenced the decision made, and (2) the end of the first battle period which will reveal how the decision made influenced early tactical operations.

- Battalion commanders guidance (video tape) which was issued to the command group to guide staff planning. This information should reveal the extent to which the commander may have influenced staff planning.

- Staff estimates of the situation and recommendations to the commander (video tape), which should relate staff recommendations to the decision made.

- Commander's estimate of the situation and decision (video tape), which should indicate how the situation was perceived by the command group and the extent to which sound doctrine was applied in the decision made.

- Battalion operation order (video tape or written).

5.2.2 Operational Decisions

Once the simulated battle has begun, additinal information will be input to the battalion command group by controllers representing the brigade, the subordinate units of the battalion, and supporting and adjacent organizations. All of the inputs are informative; however, some particular input or an accumulation of inputs will demand that subsequent decisions be made. These subsequent decisions (represented in fragmentary orders) and the timing with which they are made should be evaluated for quality. Aids to assist in this evaluation include

- Inputs of significant scenario information as revealed by the chronological log maintained by exercise supervisory personnel.
- Battle situation reports for the time periods associated with decisions made.
- Information processing and recommendations made by battalion staff sections (video tapes).

5.2.3 Battle Outcome

At the conclusion of the training exercise, the quality of the sum of the tactical decisions may be evaluated subjectively by considering the following:

- Mission accomplishment as revealed by ground gained or lost, or other quantitative measure of mission performance (Beginning and end operation overlays).
- Relative combat power at exercise completion (battle situation reports).

- Battle outcome scores (LER and RER) compared to scores achieved by other battalion command groups for the same exercise.

5.3 EVALUATION OF STAFF FUNCTIONAL PERFORMANCE

The evaluation of staff functional performance (personnel, intelligence, operations and logistics) as well as performance of the battalion task force commander may be accomplished using the video tapes of the planning and execution phases of the exercise and the evaluation scoresheets contained in Appendix F. All performance elements contained on the scoresheets do not require evaluation but may be used selectively by the evaluators.

5.4 EVALUATION OF STAFF PROCEDURES

Staff procedures to be evaluated are primarily those included in the standing operating procedures (SOP) of the battalion participating in the training exercise. An SOP lists procedures that are unique to the organization and are used habitually for accomplishing routine or recurring actions or matters. The SOP facilitates and expedites operations by reducing the number, length, and frequency of other types of orders; by simplifying training; by promoting understanding and teamwork among the commander, staff, and troops; by advising new personnel or newly attached units of procedures followed in the organization; and by reducing confusion and errors. The training exercise offers an opportunity to verify and/or to amend existing procedures to meet the objectives discussed.

Procedural matters which might be evaluated by viewing the video tapes inlude but are not limited to

- o Staff organization; inter-staff section coordination procedures.
- o Communications-electronics procedures not covered by CEOI.
- o Command post organization, echelonment, and security.
- o Requirements for, and procedures in, reporting special interest information.
- o Content and schedule for submission of routine reports.
- o Responsibilities for liaison and coordination.
- o Procedures for requesting information and support.

SECTION 6
RECOMMENDATIONS

The command group performance data collection, analysis, and performance system (CGPDARS) is not operational at the time of this report. The audio/visual recording system for CATTS has been dismantled, and the system for MACE has not yet been acquired and installed. In the event that an audio/visual recording system is acquired and installed at Fort Leavenworth to support MACE, the following recommendations are submitted:

1- That the audio/visual recording system be designed and acquired as an electronically balanced and interoperable system. Linked system components should exhibit operating characteristics which will optimally produce the feedback package components described in this report.

2- That video cassette recorders with a dual audio track recording capability be acquired. One audio track will record audible sounds from area microphones in command post locations, and the second track will record selected two-way communications inherent in exercise play.

3- That the time-code generator for generation of characters on the video tapes be synchronized for operation from a single switch rather than from current multiple switches.

4- That a large screen display system of the tactical situation be procured for the controller room and that a capability be developed to frequently record the time-tagged tactical situation on a take home video tape of the feedback package. This capability will facilitate evaluation of command group performance recorded on video tapes in light of the corresponding tactical situation.

5- That video cameras installed in command post facilities be capable of panning by remote control to enable changes of viewing area within the command post.

6- That the switching arrangement for the video system for changing communications frequencies from primary to alternate channels also control channel use on the audio recorder.

SECTION 7
REFERENCE

1- Department of the Army Contract No. MDA903-81-C-0254 as amended through Modification P00013.

2- SAI Annual Technical Report: Command Group Behaviors: Their Identification, Quantification, and Impact on Collective Output in Automated and Non-Automated Environments; Objective 1: Identification and Analysis of Battalion Command Group Behaviors. May 1983.

APPENDIX A
BIBLIOGRAPHY

Department of the Army, Army Regulation 310-25, Dictionary of United States Army Terms

Department of the Army, Army Training and Evaluation Program 71-2, Battalion/Task Force Command Group and Staff

Department of the Army, Army Training and Evaluation Program 100-1, Maneuver Brigade Command Group and Staff

Department of the Army, Army Training and Evaluation Program 100-2, Division Command Group and Staff

Department of the Army, Field Manual 30-5, Combat Intelligence

Department of the Army, Field Manual 61-100, The Division

Department of the Army, Field Manual 71-2, The Tank and Mechanized Infantry Battalion Task Force

Department of the Army, Field Manual 71-100, Armored and Mechanized Division Operations

Department of the Army, Field Manual 100-5, Operations

Department of the Army, Field Manual 101-5, Staff Organization and Operations (Draft) June 1981

Department of the Army, Field Manual 101-10-1, Staff Officers Field Manual - Organizational, Technical and Logistical Data, Unclassified Data

Human Resources Research Organization, Technical Report 73-19, Components of Organizational Competence: Test of a Conceptual Framework, Olmstead, J.L., et al; August 1973

US Army Combat Developments Command, Pamphlet 71-1, Force Development: The Measure of Effectiveness: January 1973

US Army Command and General Staff College, Reference Book 101-1, Organizational Data For the Army in the Field, June 1982

US Army Command and General Staff College, Reference Book 101-999 (Test), Staff Officers Handbook, December 1981

US Army Organizational Effectiveness Training Center Reference Book 26-5, Guide to Assessment of Organizational Performance for Battle Staffs, December 1978

US Army Research Institute for the Behavioral and Social Sciences, Technical Report 78-A18, Research on Training of Brigade Command Groups: Factors Contributing to Unit Combat Readiness: Olmstead, J.A., et al, June 1978

US Army Research Institute Field Unit, The Impact of CATTS System Characteristics on Selected Measures of Battalion Command Group Performance, Thomas, G.S., Barber, H.F., and Kaplan, I.T., Fort Leavenworth, KS, November 1982

US Army Research Institute Field Unit, Battle Simulation Outcomes as Potential Measures of Battalion Command Group Performance in CATTS Exercises, Thomas, G.S., Fort Leavenworth, KS, March 1983

APPENDIX B

ACRONYM GLOSSARY

AA	- active Army
ABN	- airborne
ALO	- air liaison officer
ARI	- Army Research Institute
ARNG	- Army National Guard
ARTBASS	- Army Training Battle Simulation System
ARTY	- artillery
ARTEP	- army training and evaluation program
ASP	- ammunition supply point
BDE	- brigade
BN	- battalion
BSD	- Battle Simulations Directorate
CACDA	- Combined Arms Combat Developments Activity
CAORA	- Combined Arms Operations Research Activity
CATRADA	- Combined Arms Training Development Activity
CATTS	- Combined Arms Tactical Training Simulator
CAV	- cavalry
CEOI	- communications-electronics operation instructions
CGPDARS	- command group performance data collection, analysis, and performance system
CMD	- command
CO	- commanding officer, company
COMM O	- communications officer
COTR	- contracting officer's technical representative
CSS	- combat service support
DP	- distributing point
DPFO	- data processing field office
DS	- direct support
EEI	- essential elements of information
ENGR	- engineer
EW	- electronic warfare
FIST	- fire support team
FM	- field manual
FSO	- fire support officer
GP	- group
GSR	- ground surveillance radar
INF	- infantry
I/O	- input/output
IR	- infrared
JTOC	- jump (alternate) tactical operations center
LER	- loss exchange ratio
LT	- light
MACE	- (battalion level battle simulation-not an acronym)
MSR	- main supply route
MTI	- moving target indicator
NBC	- nuclear, biological, chemical
NCO	- non-commissioned officer

OER	- officer efficiency report
OESO	- organizational effectiveness staff officer
OPFOR	- opposing forces
OP O	- operation order
OTSD	- Operations and Training Simulation Directorate
PDS	- personnel daily summary
PW	- prisoner of war
RATT	- radio teletype
RER	- relative loss exchange ratio
RTO	- radio telephone operator
SAI	- Science Applications, Inc (now SAIC)
SAIC	- Science Applications International Corporation
SLAR	- side looking airborne radar
SOP	- standing operating procedure
SQDN	- squadron
SUP PT	- supply point
TACP	- tactical air control party
TCP	- traffic control point
TDS	- Training Development Study
TOC	- tactical operations center
TV	- television
VCG	- video character generator
VCR	- video cassette recorder

APPENDIX C

CONSULTANT RESUMES

This appendix includes resumes of senior military consultants who participated in the analysis of CATTS exercise command group behavior.

Harold B. Aldrich, Lt Col, US Army (Retired)
James N. Beil, Colonel, US Army (Retired)
George H. Young, Jr., B Gen, US Army (Retired)

231 3d Avenue
Leavenworth, KS 66048
H: (913) 682-9862
O: (913) 727-3233/3234

RESUME OF:
H.B. (BUCK) ALDRICH

JOB OBJECTIVE

Military Operations Analyst/Systems Analyst leading to Study Project Management.

EDUCATION

1972	MBA, (ADP) The George Washington University
1959	BA (Economics) Bowdoin College
1973	Industrial College of the Armed Forces (Extension)
1971	U.S. Army Command and General Staff College (Non Resident)

EXPERIENCE

4-80 - Present	College Instructor, St Mary College, Treasurer LvnCntyHistSoc, Treasurer, City of L
6/79-4-80	Deputy Director, Automation Management US Army Recruiting Command, Fort Sheridan, Illinois 60037
11/76-6/79	Branch and Division Chief US Army Combined Arms Combat Developments Activity Fort Leavenworth, Kansas 60027
6/76-11/76	Information Systems Officer US Army and General Staff College Fort Leavenworth, Kansas 60027
9/73-6/76	MASSTER Liaison Officer US Army Combined Arms Combat Developments Activity Fort Leavenworth, Kansas 60027
2/72-9/73	Branch Chief HQ, Modern Army Selected Systems Test, Evaluation, and Review Fort Hood, Texas 76544
5/60-2/72	Normal military assignments, schools, command, staff and combat tours

PERSONAL

Born:	25/9/37 in New York City, New York
Appearance:	Height: 5'8", Weight: 135
Health:	Excellent
Residence:	Own home
Finances:	US Army Retired
Hobbies:	Jogging, antiques, history, carpentry
Affiliations:	Masonic, MENSA, historical societies
Marital Status:	Married - no children

July 1979 - Present

Deputy Director, Automation Management Directorate, United States Army Recruiting Command. Responsible for budget, training, plans and programs, and staff coordination for a 95 person directorate. Selected as Chief of an eight person MIS implementation group charged to develop objective ADP system to support the headquarters and sixty-three subordinate organizations. Developed and obtained approval for initial system's requirements document within three months. Worked closely with staff to develop subsystem functional requirements, for Government's Request for ADP skills and basic management techniques, the development of a rapid understanding of the organization and its mission. This was exceedingly valuable, as the Recruiting Command, unlike most Army elements, is a sales organization, requiring knowledge of marketing, sales promotion and selling techniques. While still responsible for development of MIS for organization was also assigned responsibility for supervision of USAREC Data Processing Installation. This system uses a dual processor management procedures for scheduling, instructions, documentation, problem reporting and follow-up and had system on time in less than 45 days. Selected as Army representative on Joint Task Force to develop mobilization plans with other Armed Service representatives and the Selected Service Systems.

November 1978 - June 1979

Chief, Tactical Operations System Development Division, US Army Combined Arms Combat Developments Activity. Responsible for directing a study effort to identify the major architecture and requirements for an executive MIS operating at levels from Army Corps to combat Battalion. Study effort conducted by contractor requiring frequent coordination and evaluation. Supervised staff of six field grade officers and one professional civilian. Extremely foresighted in identifying program problems well in advance and in coordinating at mid level executive level those actions to preclude realization of same. The job required detailed knowledge of tactics, intelligence, command and staff procedures as well as systems analysis, automatic data processing and management. Job was voluntarily taken as lateral movement in that the study effort was technically challenging, difficult and offered promise of considerable value to the Army. During period was selected as a special representative to Intelligence Working Group of the Joint Integrated Tactical Command and Combat System. JINTA

November 1976 - November 1978

Chief, Tactical Operations System Fielding Division. Responsible for directing efforts of five field grade officers and two professional civilians in identifying requirements for the first militarized tactical command and control systems (MIS) for the Army division. Assuming this responsibility at a time when a first series of tests had been viewed by many as unsuccessful, and the TOS system was under attack from many directions for a variety of reasons, undertook to redesign a segmented system built without concept into a unified, coherent system. Able to apply sound background in tactics command and control and ADP. Developed subordinates into a team. Conceptualized and developed a generalized system definition that would allow, through flexible output routines, a system that's use could be modified to react dynamically to changing information requirements of the battlefield of the future.

Developed and initiated procedures for the development of multi-system interfaces two years before Army guidance and procedures were published. Initiated and participated in programs which allowed the user to clearly explain his requirements to the software system analysts. Voluntarily accepted job transfer when the most critical design tasks had been accomplished and effort was nearly completed and apparently out of jeopardy.

June 1976 - November 1976

Information Systems Officer, Command and General Staff College and ADP Resources Coordinator for the Combined Arms Center. Responsible for coordinating use of the computer to support nearly one thousand officer students at the CGSC working for the college secretary (VP for Administration). Also developed plans and programs for use of ADP for the entire post. In this capacity worked for the Chief of Staff (Executive VP). First position was eliminated due to reorganization. Second position was filled by a Colonel.

September 1973 - June 1976

TCATA (TRADOC Combined Arms Test Activity) formerly MASSTER (Modern Army Selected System Test, Evaluation and Review) Liaison Officer to the Combined Arms Center. Responsible for presenting the views of Commanding General MASSTER to personnel of the Combined Arms Center (CAC) and assuring timely, adequate and meaningful information flow. Was asked personally by CG MASSTER to voluntarily accept this job when five courses short of PhD class requirements at American Technical University. Accepted because of opportunity, challenge and chance to act on own initiative with considerable authority. Based on previous test and command and control experience was able to participate actively as a staff action officer for CAC in system definition process for TOS. Demonstrated capability and willingness to help gain the position and respect of CAC personnel and helped to eliminate serious rift between the two organizations. Chief data base designer and system demonstrator RTOS GOOS demonstration produced by CAC for CG TRADOC (still as MASSTER LNO). Experience in tactical command and control qualified individual to be Chief Special Evaluation for Joint Task Force in two large scale special project maneuvers dealing with compartmented intelligence and staff procedures. Observation of supervisor was "was able to act so well in accomplishing his mission, that on reassignment, there was no need to replace him".

February 1972 - September 1973

Chief, ADP System Integration Branch, CC&C Director, HQ MASSTER, Fort Hood, Texas. Responsible for supervising efforts of five field grade officers, one professional civilian and 4-5 contractor personnel in defining requirements for, supervising development of and conducting comprehensive test of three alternate methods for computer driven large screen displays.

June 1970 - January 1972

Student, George Washington University, Washington, D.C., MBA in ADP. Thesis - "Motivational Effects of the Army Personnel Management System".

OTHER ACTIVITIES

- Master, Hancock Lodge No. 311 AFDAM - 1978
- President, Fort Leavenworth Chapter 154 National Sojourners - 1976,1977
- Commander, Old Frontier Camp "Heros of 76" - 1977
- Venerable Master, Lodge of Perfection Armed Forces Scottish Rite Bodies - 1976-1979
- Patron, Army Chapter 334, Order of the Eastern Star - 1978
- QM, 1st Lt, Corresponding Secretary, Abdullah Shrine (AAONMS) Foot Patrol - Present
- Coordinator, Episcopal Congregation, Memorial Chapel, Fort Leavenworth, Kansas - 1977,1978
- Licensed Lay Reader Episcopal Diocese of Kansas
- Fort Leavenworth Historical History Society:
  - Program Director - 1976
  - Secretary/Treasurer - 1977
  - Secretary - 1978
- Former Scoutmaster, Assistant Scoutmaster, Merit Badge Counselor

EDUCATIONAL BACKGROUND

Civilian:

PhD, Candidate American Technological University - 1972/73 (approximately 21 hours beyond MBA)

MBA, (ADP) George Washington University - 1972

BA, (Economics) Bowdoin College - 1959

Military:

National Security Management, Industrial College of the Armed Forces (extension) - 1976

US Army Command and General Staff College (extension) - 1971

Military Assistance Training Advisor Course - 1969

Installation Management, US Army Management School - 1968

Infantry Officer Career Course (Honor Graduate) - 1967

Infantry Officer Basic (extension) - 1963

Transportation Officer Basic - 1960

James N. Beil

Colonel, USA Retired

Summary of Assignments

Dates From	To	Job
Nov 82	Mar 83	Consultant, SAI, Command Group Behavior
Nov 76	Mar 80	Director, Scenarios & War Games Directorate, CACDA
Oct 75	Nov 76	Chief, Scores Divison; Concepts, Force Design Directorate, CACDA
Jan 72	Oct 75	Chief, Studies Division, Concepts, Force Design Directorate, CACDA
Jul 70	Jan 72	Project Officer & Chief; TOS Group ICAS, US Army
Nov 69	Jun 70	Commander, 5th Battalion/27th FA , RVN
Jul 69	Nov 69	S-1, IFFV Corps Arty, RVN
Jun 67	May 69	Instructor, Department of Command CGSC
Jul 66	Jun 67	Student, CGSC
Jun 64	Jun 66	G-1, G-3, Advisor; MAAG, Taiwan
Jun 63	May 64	SGS, 4th Inf Div, Ft Lewis, WN
Oct 61	Jun 63	S-3, 6th/29th FA Bn Ft. Lewis, WN
Aug 61	Oct 61	S-4, 6th Battalion/29th FA Ft. Lewis, WN
Aug 60	Aug 61	FA Advisor, Team 6, Iran
Apr 57	Jun 59	ROTC Instructor, Gonzaga University Spokane, WN

James N. Beil, COL, USA Retired

Dates From	To	Job
Dec 55	Sep 56	Battery Commander, 48th AAA Bn (1st Inf Div), Ft Riley, KS
Jun 55	Dec 55	Batery Executive Officer, 48th AAA Bn (1st Inf Div), Ft Riley, KS
Oct 54	Jun 55	Battery Commander, 67th AAA Bn Worms, Germany
Oct 52	Oct 54	Battery Officer, 67th AAA Bn Worms, Germany

Education

BS, General Science, Colorado State University, 1951

Graduage, US Army Command and General Staff College, 1967

GEORGE H. YOUNG, JR.
207 Vine Street
Leavenworth, Kansas 66048
913-651-5727 (home)

MANAGEMENT EXPERIENCE

Corporate Personnel Relations Director (reporting administratively to the chief operating officer) of a prominent NYSE manufacturer of automatic merchandising equipment. Significant accomplishments:

- Developed and administered positive personnel policies and procedures for a work force of approximately 700 salaried and 2,000 non-exempt employees.
- Developed and implemented a completely revised salaried employee compensation program. Included recommending salary structures, preparation of cost estimates, receiving top management approval and finally, initiating budget procedures to provide proper monitoring and control.
- Personally negotiate and administer four separate labor agreements. Includes day-to-day administration of these contracts, preparing and presenting arbitration cases and functioning as chief negotiator at the bargaining table.
- Successfully maintained non-union status at two locations by directing aggressive union avoidance programs.
- Successfully defended the corporation's position at several NLRB hearings and EEO investigations.
- Prepared and implemented Affirmative Action Plans. Personally worked with OFCC compliance review officers, having never lost a contract due to non-compliance.
- Workmen's compensation has been reduced by more than 25% due to the development and installation of detailed, workable safety plans and procedures.
- Responsible for fringe benefit planning and implementation. This includes the monitoring of benefit costs via a cost tracking system and the implementation of various methods of communicating fringe benefits to all employees.
- Supervised adherence to OSHA and ERISA provisions at all corporate locations.

Meaningful armed forces service, eight years of which as a senior executive. Experienced administrator in the fields of personnel, operations and logistics. Significant military career accomplishments were:

- Administered development of personnel plans and procedures at Department of the Army and operating command levels.

- Chief operations officer, U.S. Army, Vietnam, for a period of two years. Major duties encompassed supervision of a staff of approximately 200 and responsibility for development and supervision of implementation of offensive and defensive plans for entire Army element within the theater of operations.

- Executive assistant responsible to supervise the evacuation of all U.S. Army material, equipment, and personnel from France (1965-66).

- Directed and managed twelve rebuild/storage installations of 12,000 employees involved in the repair of tanks, trucks, mechanized vehicles, helicopters, rifles, machine guns, and larger weapons.

- Senior logistics planner responsible for all logistical matters pertaining to equipping, housing, clothing, feeding and re-supplying a fighting force of 250,000 soldiers. Chief executive officer responsible for the procurement of supplies and the negotiation of all foreign labor contracts/agreements.

PERSONAL DATA

6'½"; 155 pounds; married with two children; excellent health.

EDUCATION

- B.S., The Citadel, 1942
- M.S. in Mechanical Engineering, University of Southern California, 1958.
- M.B.A., George Washington University, 1962.
- The Command and General Staff College, 1946.
- The Armed Forces Staff College, 1954.
- The Industrial College of the Armed Forces, 1962.

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- The Command and General Staff College, 1946.
- The Armed Forces Staff College, 1954.
- The Industrial College of the Armed Forces, 1962.

DRAFT

APPENDIX D

INSTRUMENTATION ENHANCEMENT PLAN

This appendix contains the CATTS Instrumentation Enhancement Plan prepared by SAIC under Contract No. MDA903-81-C-0254.

August 31, 1982

Army Research Institute Field Unit
Post Office Box 3122
Fort Leavenworth, Kansas 66027

Attention: Mr. Steven R. Stewart, COTR

Dear Mr. Stewart:

Reference is made to Contract MDA903-81-C-0254 through Modification P00004.

Science Applications, Incorporated, (SAI) submits herewith a Combined Arms Tactical Training Simulator (CATTS) Instrumentation Enhancement Plan. The plan responds specifically to the requirement of the contract to identify what, if any, audio/visual hardware modifications/additions may be necessary to capture better data for more detailed study and analysis. The plan addresses contractor acquired property authorized by contract Modification (P00004) to be purchased for the account of the Government, except as follows:

Added (essential to data collection):

Video, audio, and computer tapes for recording simulation exercises

Time code reader for 20 channel audio player

Video monitors (2) for observation and analysis of video tapes

Video recorder for recording the tactical display for analysis and feedback purposes

Color video camera system

Video editor technician labor

Deleted (no longer necessary):

Tactical display monitor (cabling only)

Graphics recording timer

Audio feedback controller

Headphones (3)

The amended list has been recosted, and the estimated costs shown in the plan are current. Additional analyses and coordination are necessary, however, to determine if the color video camera system (Priority 15) and the video editor, tapes, and technician labor (Priority 16) are cost effective. Until these systems are determined to be cost effective, SAI will not take action to acquire them.

The acquisition and installation of planned instrumentation which is to be installed in the CATTS facility has been coordinated with the Combined Arms Training Developments Activity (CATRADA), except for the video editor, tapes, and technician labor. Coordination for the acquisition of this latter system will continue until a decision is reached.

Your early consideration and approval of this plan will be appreciated.

Yours very truly,

SCIENCE APPLICATIONS, INC.

Charles Carter, Jr.

Charles F. Carter, Jr.
Senior Operations Analyst

Enclosure

CC: Michael Walker, SAI McLean
James Drake, SAI McLean

COMBINED ARMS TACTICAL TRAINING SIMULATOR (CATTS)
INSTRUMENTATION ENHANCEMENT PLAN

1. PURPOSE

The purpose of this plan is to identify and recommend instrumentation enhancements to the Combined Arms Tactical Training Simulator (CATTS) system which will more effectively record exercise data and thus provide

- Better observation and evaluation of battalion command group performance by the Combined Arms Training Developments Activity (CATRADA).
- Another means of providing performance feedback to battalion command groups undergoing training in CATTS.
- More effective collection of subjective and objective staff behavioral data by the Army Research Institute (ARI) to support evaluation of battalion command group behavior and effectiveness.

2. BACKGROUND

CATTS has been instrumented in a manner to meet evolving requirements to obtain observations and data relating to exercise play by selected battalion command groups. One current requirement is to provide data which will permit ARI to develop and apply a methodology for differentiating the non-procedural individual and multi-individual behaviors from team behaviors in battalion command groups and for determining their respective contribution to command group effectiveness.

CATTS is presently instrumented for audio recording as diagrammed in Figure 1 and for video recording as diagrammed in Figure 2. The ARI/SAI laboratory currently used to observe and

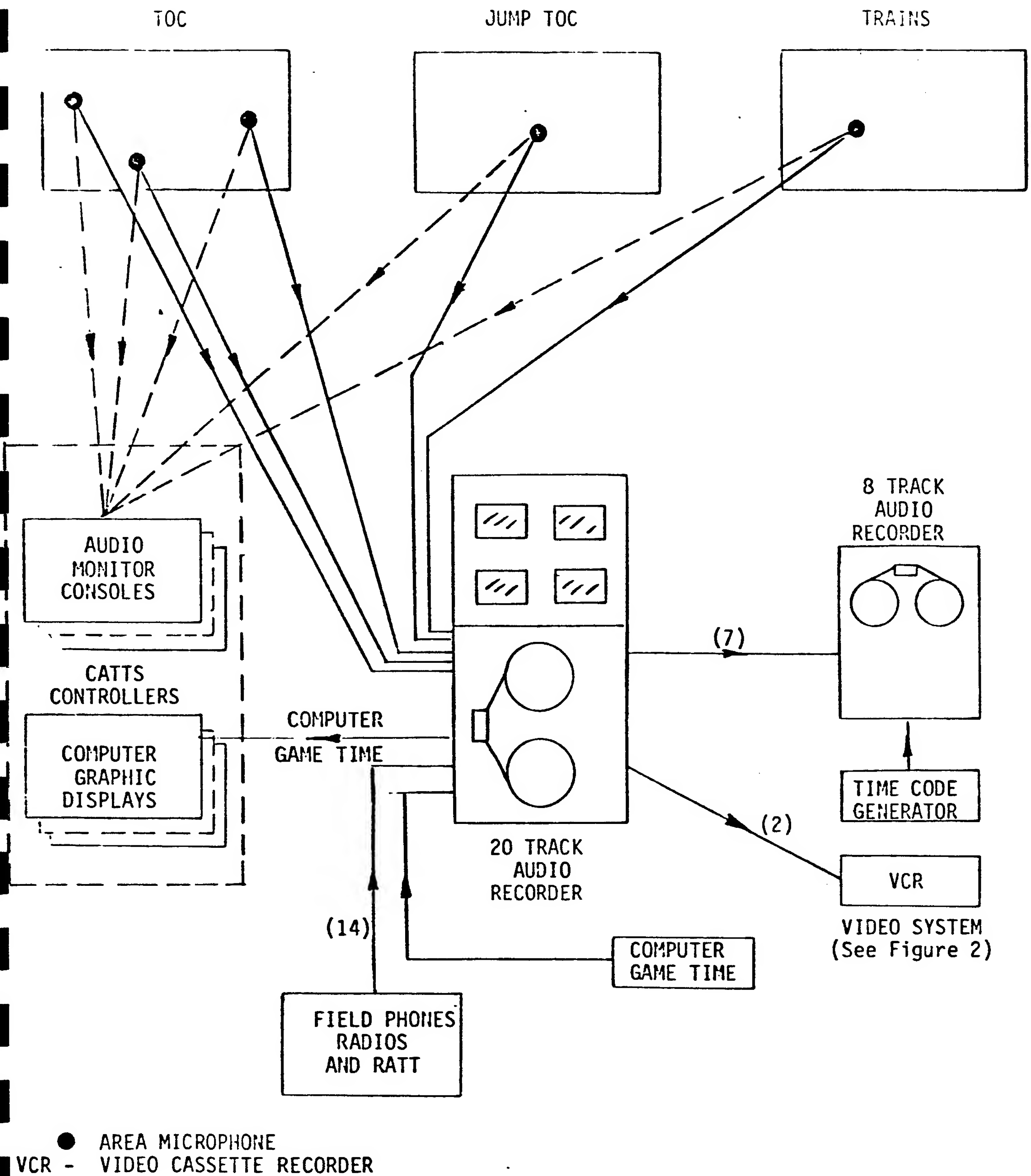


Figure 1. Audio Recording System

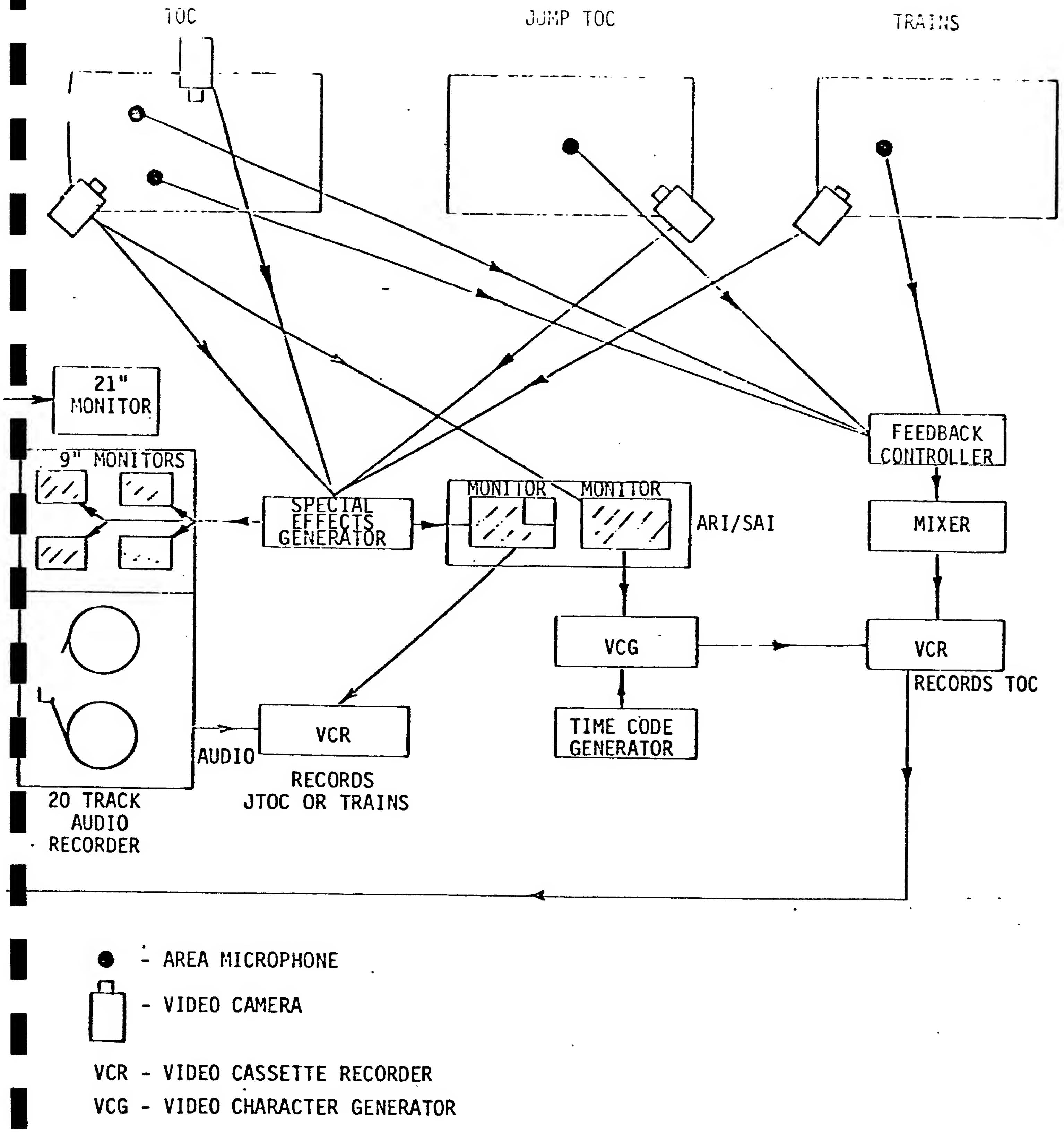


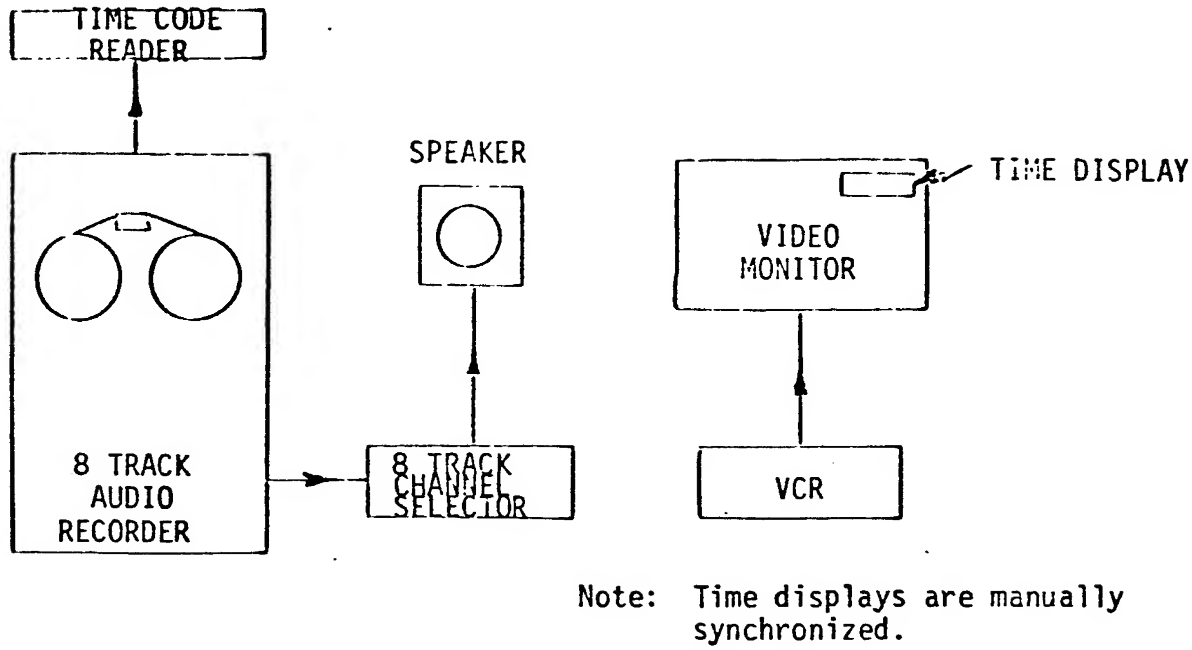
Figure 2. Video Recording System

analyze command group behavior is diagrammed in Figure 3. In order to support the ARI data recording requirements, the current CATTS instrumentation exhibits the following shortfalls in recording capability:

- Audio recordings on the existing 20-channel recorder are not adequately time-tagged to permit correlation between audio and video recordings.
- Audio playback of current recordings is severely limited by existing equipment in terms of quality, quantity, and accessibility to recorded information.
- There is not a sufficient number of video recorders in the CATTS facility to record all command group activity.
- Tactical display information is not now being video recorded.
- Standard lenses (as distinguished from wide angle lenses) on existing video cameras do not provide optimum coverage in the CATTS facility.
- Available video monitors, because of design and age, do not permit acceptable off-line observation and analysis of command group activities.
- Area microphones in the CATTS facility do not allow acceptable fidelity and ready discrimination among conversations and other communications.
- An electronic computing system is not available to support data recording, sorting, storage, retrieval and display as well as to provide computational and analytical support of research and development activities.

3. ASSUMPTION

It is assumed that system instrumentation and data collection and analysis will be required for the duration of the current ARI/SAI contract (through March 1984), whether the data are collected from CATTS exercises or from exercises using the Army Training Battle Simulation System (ARTBASS).



VCR - VIDEO CASSETTE RECORDER

Figure 3. Audio and Video Observation Systems

4. INSTRUMENTATION ENHANCEMENT PLAN

In order to improve the capabilities of the current CATTS instrumentation, the general approach and the specific enhancements discussed below are recommended.

4.1 GENERAL APPROACH

A major objective of the instrumentation enhancement plan will be to improve the CATTS instrumentation system sufficient to provide the quality and quantity of behavior information necessary to evaluate the contribution of command group behavior to command group effectiveness.

The following guidelines will be used to identify the enhancements and to establish a priority for the acquisition of new instrumentation system components or for the modification of existing components.

- The highest priority must be accorded to the support of the existing instrumentation system.
- Enhancements identified and implemented must be necessary to the acquisition of data useful to both CATRADA and ARI.
- Enhancements must have a relatively long term usefulness in data acquisition and analysis.
- New system components must be compatible in terms of interface and interoperability with all other system components.
- Equipments must be cost effective in terms of available contract resources.

4.2 SPECIFIC ENHANCEMENTS AND SUPPORT

A major task of Objective 1 during the first contract year was to review and analyze the video/audio tape sets of CATTS exercises as a means of analytical methodology formulation and identification of what, if any, audio/visual hardware modifica-

tions/additions may be necessary in order to capture better data for more detailed study and analysis. The completion of this task lead to the enhancements recommended in this plan.

Specific enhancements recommended for the CATTS instrumentation system are included in Table 1 in order of priority for their acquisition. A more detailed rationale and justification of each enhancement and support item is included in Appendix A.

The enhanced audio and video recording systems for CATTS are displayed in Figures 4 and 5 respectively, and the new components are highlighted by heavy black lines. Similarly, the enhanced laboratory which ARI/SAI will use to observe and analyze command group behaviors is diagrammed in Figure 6.

5. PLAN APPROVAL

Approval of this plan by the ARI contracting officer, or his authorized representative, constitutes authority for SAI to acquire and install system enhancements. System enhancements will be installed in complete coordination with CATTS management personnel at a time when the installation will not interfere with the conduct of CATTS exercises.

Enhancements acquired under this plan become deliverables under the terms of Contract MDA903-81-C-0254 and correspondingly become the property of the government upon completion of the contract.

Appendix A - Detailed Enhancements Justification

Table 1. Instrumentation Enhancement Plan Summary

PRIORITY	PACKAGE ID	PACKAGE	COST ($)		REF
			*CY 2	*CY 3	
1	VIDTAPE1	Video cassette tapes (current recorders) 480 @ $16	3,072	4,608	
2	AUDTAPE	Audio tapes, 20 channel (current recorder) 40 @ $65	1,040	1,560	
3	TACTAPE	Computer tapes 120 @ $16	768	1,152	
4	TAPE20	Twenty channel audio player	4,500		
4	TP20TIME	Time code reader for TAPE20	1,300		
5	TIMEREC	Time coder generator for TR-1720	1,700		
6	REC1	Video recorder systems (2) $13,480 Video recorder 2 @ $1400 ($2,800) Video character generator 2 @ $1200 ($2,400) Video cassette tapes 480 @ $16 ($7,680) Connecting cables ($100) Equipment rack ($500)	8,872	4,608	
7	TV1	Video monitor	500		
8	TV2	Video monitor	500		
9	LENSES	Wide angle video lenses 2 @ $130	260		
10	REC2	Video recorder systems (2)	5,200		
11	MIKE1	Microphone system, cordless	1,400		

*CY = Contract Year

Table 1. Instrumentation Enhancement Plan Summary (Concluded)

PRIORITY	PACKAGE ID	PACKAGE	COST ($) *CY 2	*CY 3	REF
12	MIKE2	Microphone system, cordless	1,400		
13	INSTRUMT	Laboratory data recording device	3,000		
14	TACREC	Video recorder for tactical display	1,400		
14	VIDTAPE2	Video cassette tapes 240 @ $16	1,536	2,304	
15	COLOR	Color video camera system	20,000		
16	EDIT	Video editor	8,000		
16	VIDTAPE3	Video cassettes (EDIT) 40 @ $16	480		
16	EDITPERS	Video editor technician (700 man hours per year)	9,000	9,000	

*CY = Contract Year

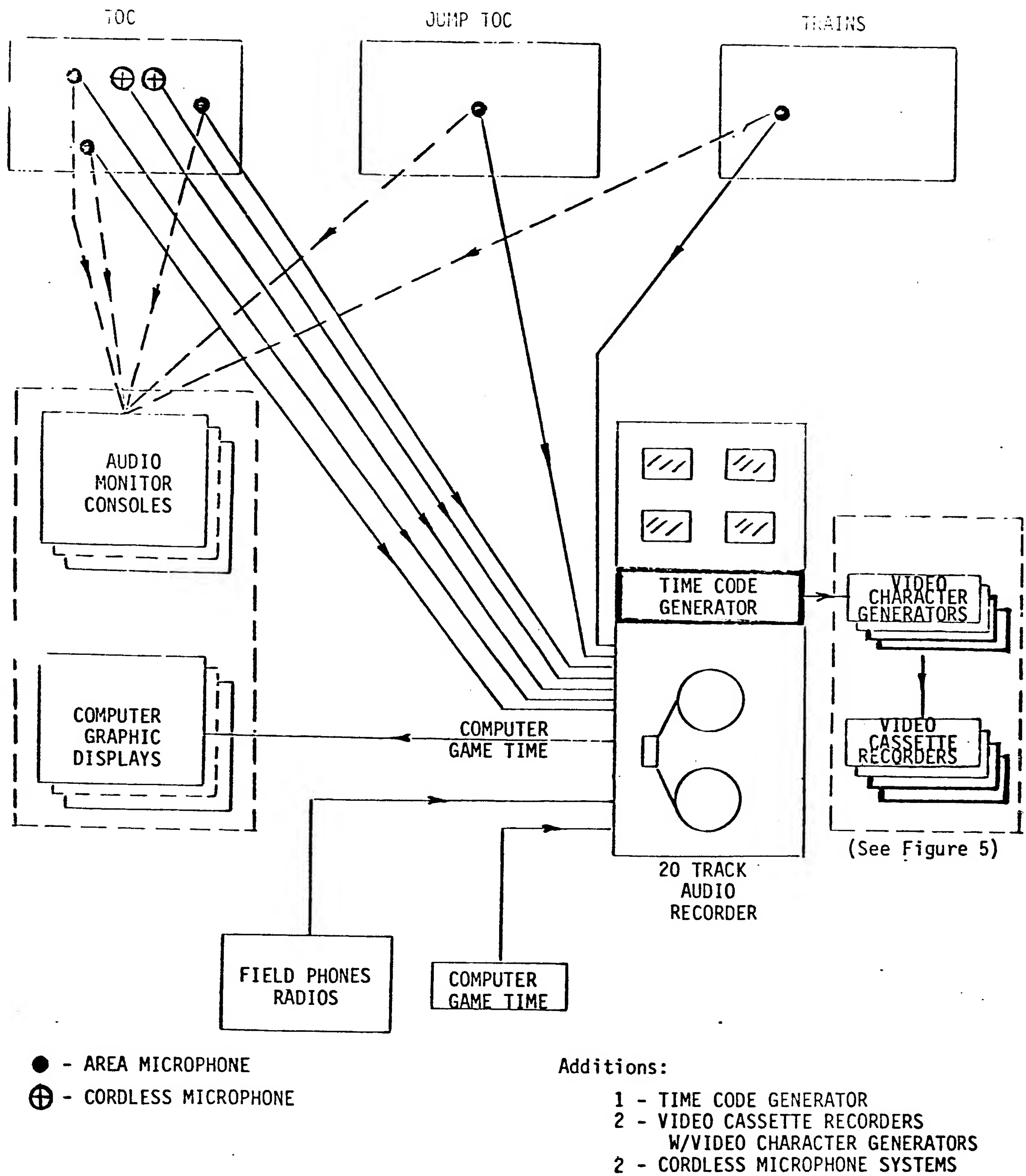


Figure 4. Enhanced Audio Recording System

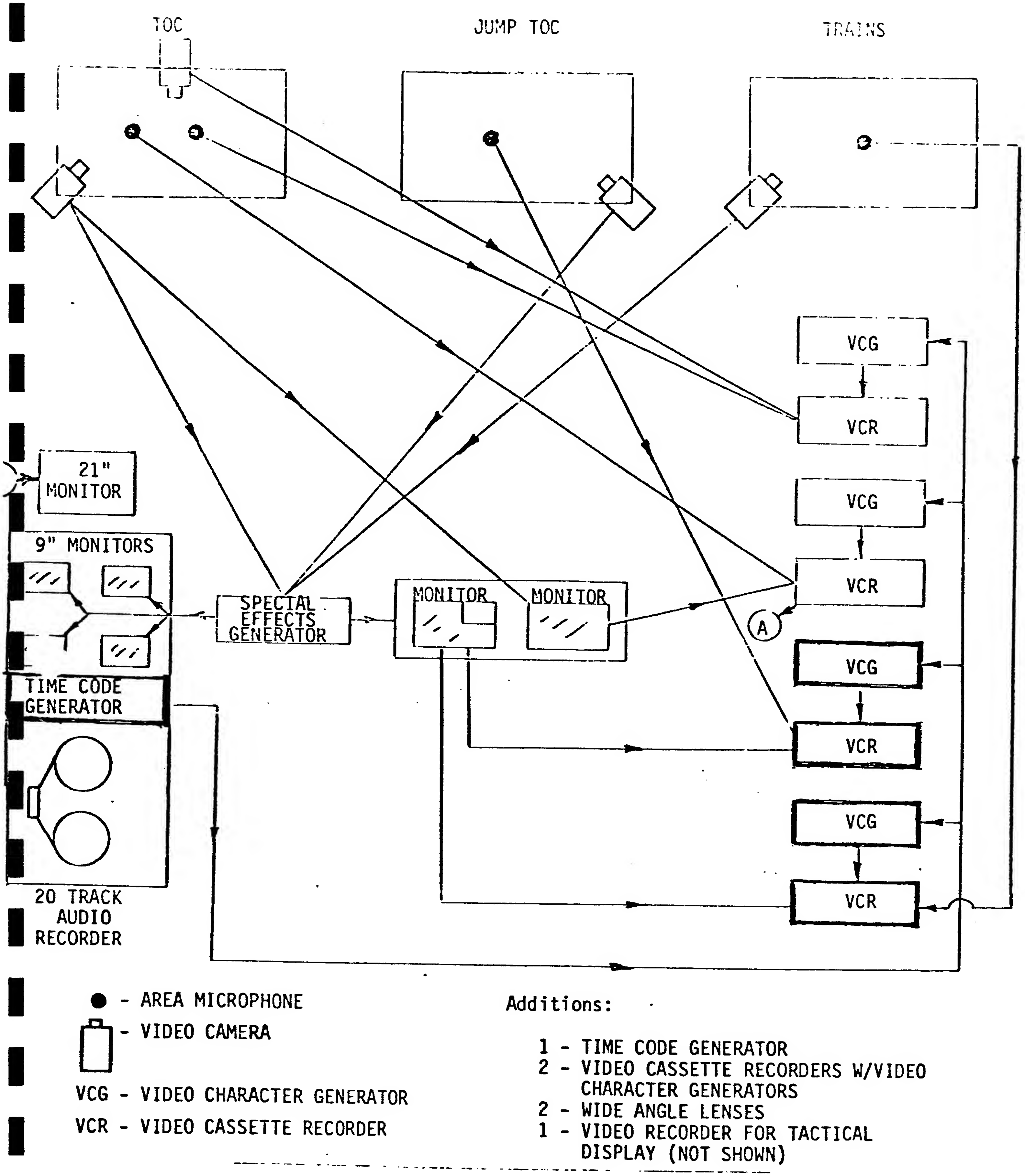


Figure 5. Enhanced Video Recording System

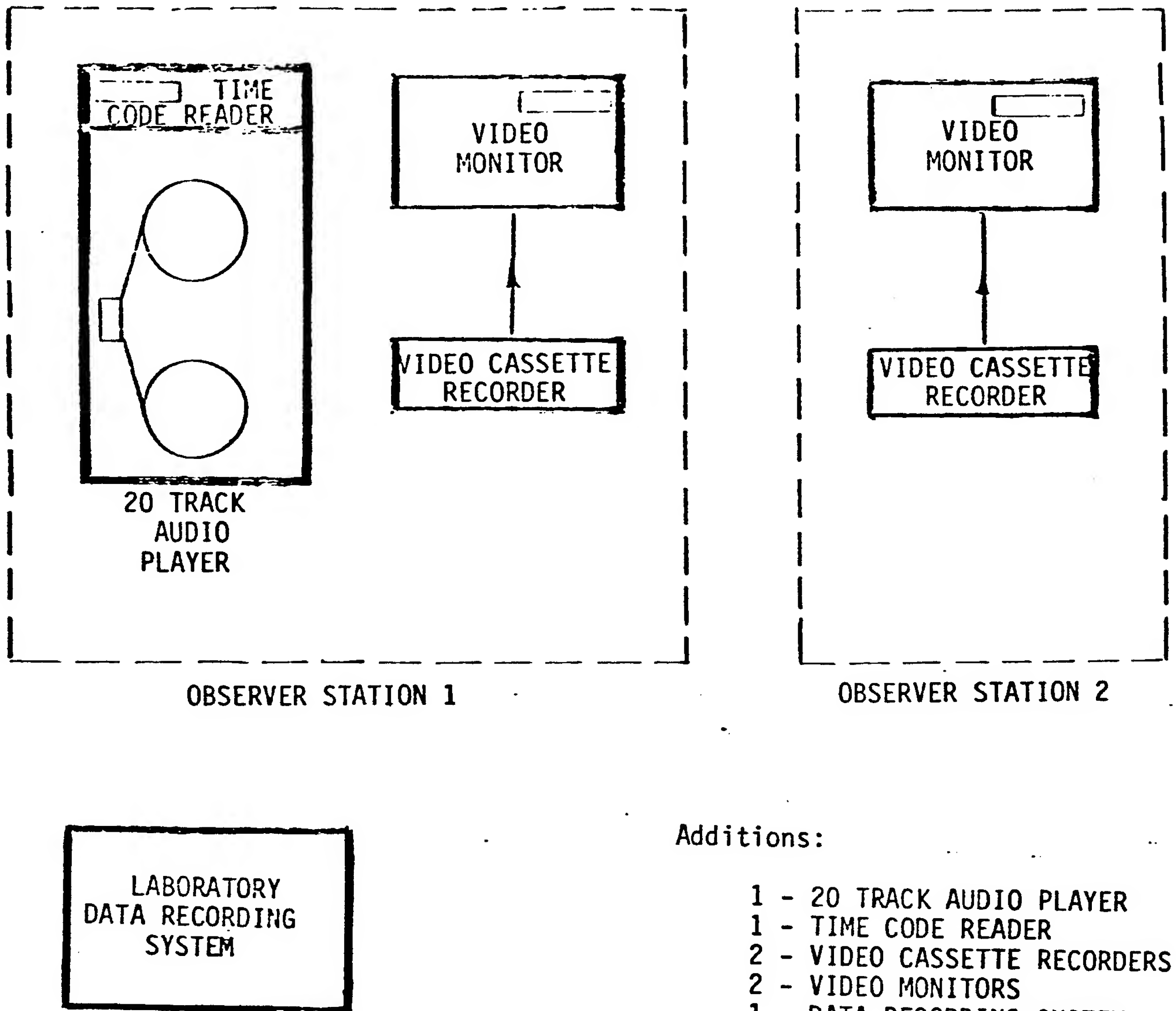


Figure 6. Enhanced Audio and Video Observation Systems

APPENDIX A

DETAILED ENHANCEMENT JUSTIFICATION

TO

CATTS

INSTRUMENTATION ENHANCEMENT PLAN

August 1982

APPENDIX A

DETAILED ENHANCEMENT JUSTIFICATION

A detailed rationale and justification for the enhancement and support of the CATTS instrumentation system is included in this appendix. In addition to the background and recommendation relating to each enhancement and support package, the following information is provided.

- Recommended priority for acquisition
- Package alphanumeric identification
- Package description
- Estimated package costs

The information contained in this appendix is summarized in Table 1 of the Instrumentation Enhancement Plan.

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
1	Video	VIDTAPE1	Video cassette tapes (for two current recorders) 480 @ $16 Background: Video recording of CATTS exercises is necessary for critique and analysis. Two video recorders are presently integral to the system and must be supplied with tapes. Tape requirements for each exercise for both recorders are 12 tapes. Contract Year 2, 16 exercises @ 12 tapes/exercise = 192 tapes @ $16 = $3,072 Contract Year 3, 24 exercises @ 12 tapes/exercise = 288 tapes @ $16 = $4,608 $7,680 Recommendation: It is recommended that video cassette tapes be acquired as needed to support recording of CATTS tactical exercises.	$7,680

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
2	Audio	AUDTAPE	Audio tape, 20-channel, 40 @ $65 Background: 20-channel audio tapes are required to record telephone, radio, and area conversations incident to the play of CATTS exercises. The recordings are subsequently used to critique the exercises and to provide data for behavior and effectiveness analysis. Recommendation: It is recommended that audio tapes be purchased on the basis of one tape per exercise. Contract Year 2 16 @ $65 = $1,040 Contract Year 3 24 @ $65 = 1,560 $2,600	$2,600

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
3	Audio/ Video	TACTAPE	Computer tape, 9 track, 2,400 foot. 120 tapes @ $16 <u>Background</u>: The computer tapes are used at the DPFO to record battle outcome information. This information will be used for combat effectiveness versus command group effectiveness analyses. <u>Recommendations</u>: It is recommended that 120 tapes be acquired to record CATTS exercises through the balance of the ARI/SAI contract. Three (3) computer tapes per exercise are required. Contract Year 2, 48 @ $16 = $ 768 Contract Year 3, 72 @ $16 = 1,152 $1,920	$1,920

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
4	Audio	TAPE20	20-channel audio player, Magnasync/Moviola, Model 2020	$4,500
4	Audio	TP20TIME	Time code reader Magnasync/Moviola TP-602, integrated into TAPE20 Background: A 20-channel audio recorder is presently located in the CATTS controller area in Rucker Hall to record all communications for later playback and analysis. The only audio player available for CATTS/ARI/SAI use off-line is an 8-channel VETTER Model D instrumentation recorder. Analysis of audio tapes now requires transcription from the 20-channel tapes to the 8-channel tapes and thus does not allow immediate access to all audio recordings. The time code reader is a vital element of the system to read time codes from the audio tape to permit synchronization with video tapes and to permit timely access to specifically time-tagged data. Recommendation: It is recommended that the Magnasync/Moviola Model TP-2020 with compatible and integrated time code reader be acquired to provide access to all recorded audio channels.	$1,300

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
5	Audio	TIMEREC	Time code generator, Magnasync/Moviola Model TR-601-2 Background: A Magnasync/Moviola audio recorder Model TR-1720 is presently installed and operating in the CATTS facility in Rucker Hall. To greatly enhance the capability to analyze the information recorded, it is necessary to impose a time code on the audio tape. The TR-601-2 will provide that capability, will be compatible with existing recording equipment, and will also be compatible with recommended playback equipment (TP-2020) to be used for observation and analysis. It is expected that the time code generator will also impose synchronized time codes on all recorded video tapes. Recommendation: It is recommended that the TR-601-2 be purchased as early as practicable to facilitate the time coding of audio and video tapes and to support analysis of command group behavior.	$1,700

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
6	Video	REC1	2 @ ½-inch video recorders w/time code generation, 480 video tapes, cabling, and equipment rack	$13,480
10	Video	REC2	2 @ ½-inch video recorders w/time code generation. Background: Three video recorders are currently available; 2 at Rucker Hall (CATTS) and 1 at McNair Hall (ARI). The recorder at McNair Hall is on loan and must be purchased or replaced. The plan is to acquire a total of 6 recorders (2 current plus REC1 plus REC2); 4 for Rucker Hall and 2 for McNair Hall. The 4 at Rucker Hall will record TOC activities (2 recorders), JTOC activities (1 recorder), and battalion trains activities (1 recorder). The 2 recorders at McNair Hall will be used by ARI/SAI for review and analysis. Recommendations: It is recommended that the recording system be upgraded to six (6) by acquiring REC1 and REC2.	5,200

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
7	Audio/ Video	TV1	Video monitor, color, 19" screen	$500
8	Audio/ Video	TV2	Video monitor, color, 19" screen Background: The black and white video monitor currently in use is antiquated and produces a very poor video picture for observation, review, and analysis. One monitor is necessary for each analyst, and two such monitors would permit concurrent analytical work. The listed monitors will permit observation of the players in the CATTS exercises, their identification by staff position, and the interpretation of color representations on maps and overlays. <u>Recommendations</u>: It is recommended that the monitors be acquired immediately to support observation and analysis.	$500

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
9	Video	LENSES	Two wide angle lenses for video recorders @ $130 Background: Wide angle lenses are presently installed in two video cameras and they have the effect of increasing the viewing and recording area by over 30%. Two additional wide angle lenses are needed for the two video cameras already installed. The two new wide angle lenses will be used in the JTOC and the BN TNS. Recommendation: It is recommended that LENSES be acquired as soon as practicable to support optimum data collection.	$260

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
11	Audio	MIKE1	Cordless microphone system, consisting of microphone transmitter receiver	$1,400
12	Audio	MIKE2	Same package as MIKE1 Background: The quality of audio recordings of key player personnel (e.g., battalion commander, S-3, and S-2) is poor, and analysis of the tapes requires careful listening and correlation of the audio and video tapes. Since these communications are key to the analysis of command group behavior and recordings provide an excellent media for critique of CATTS players, two (2) cordless microphones will significantly enhance the observation and analysis of CATTS live play. For each microphone used, an I/O channel on the 20-channel recorder is necessary. Recommendation: It is recommended that two (2) cordless microphone systems be acquired and used in recording CATTS exercises.	$1,400

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
13	Audio/ Video	INSTRUMT	Laboratory data recording device Background: A laboratory data recording devide is an essential tool for the performance of numerical and statistical analyses from large amounts of data acquired through observation of CATTS exercises. More specifically, the system will support behavior analysis, correlation analysis, feedback of battle results in near real time, computer-assisted diagnostic profiles, statistical analyses, and production of DPFO/observer data. The data recording device will be linked to the large scale computer in the DPFO for rapid access to battle results. Recommendation: It is recommended that the laboratory data recording device be acquired to assist in analyses of CATTS exercises.	$3,000

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
14	Video	TACREC	Video recorder for tactical display	$1,400
14	Video	VIDTAPE2	Video cassettes (TACREC) 240 @ $16 Background: The tactical display in the controller area is currently computer-driven and time coded; however, the information displayed is not recorded. It is highly desirable that an observer/analyst know the tactical situation compatible with command group activities and decision-making, and for those reasons the tactical situation should be recorded. It will be necessary to engineer an interface between the video recorder and the present display system. Recommendation: It is recommended that a tactical display video recorder and video tapes be acquired to complement the present display system and to permit better analysis of command group behavior.	$3,840

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
15	Video	COLOR	Color video camera with remote pan-zoom, color monitor, and video recorder <u>Background</u>: This system would be used to record situation map information as well as player personnel in the TOC. The camera is a special low light camera with the capability of reproducing high fidelity images from considerable distance (e.g., across the TOC). <u>Recommendation</u>: In the event that long term analysis of command group behavior is to be accomplished, the color video camera system is a highly desirable instrumentation upgrade to existing video cameras. It is recommended that this system be acquired only in the event that long term analysis will take place and the system is essential to the accepted analytical methodology.	$20,000

INSTRUMENTATION ENHANCEMENT PLAN

PRIORITY	SYSTEM	PACKAGE ID	PACKAGE	COST
16	Audio/ Video	EDIT	Video editor	$8,000
		VIDTAPE3	Video cassette tapes, 40 @ $16	$ 480
		EDITPERS	Video editor technician (700 man hours per year)	$9,000
			Background: The video editor would be used to edit existing video tapes and to extract and record selected portions of the existing tapes. The video editor would allow CATTS personnel to prepare special critique tapes to be supplied to battalion command groups participating in CATTS exercises for examination and use at battalion home stations. ARI/SAI would use the editor to document selected command group behaviors for special analysis. Technician is required to edit video tapes.	
			Recommendation: The video editor and technician should be acquired only if its training value to participating command groups is determined to be cost-effective.	

APPENDIX F

FEEDBACK PACKAGE
SELF-EVALUATION SCORESHEETS

This appendix contains self-evaluation scoresheets for use by battalion command groups who have participated in CATTS/MACE tactical training exercises.

Battalion Task Force Commander
S1 Section (Personnel)
S2 Section (Intelligence)
S3 Section (Operations)
S4 Section (Logistics)

CONTRACTOR PURCHASED EQUIPMENT

The equipment listed below was purchased for the account of the governmentunder Contract No. MDA903-81-C-0254 and is deliverable to the government upon completion or termination of the contract.

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NUMBER
Video cassette recorder	Panasonic	NV1300	H2HD00284
Video cassette recorder	Panasonic	NV1300	H2HD00288
Video cassette recorder	Panasonic	NV1300	H2HD00297
Video cassette recorder	Panasonic	NV8320	D1SA60168
Video cassette recorder	Panasonic	NV8320	F1SA61421
Video cassette recorder	Panasonic	NV8320	F1SA60827
Video character generator	Chrono-Log	92,131-3-11	810497
Video character generator	Chrono-Log	92,131-3-11	820695
Video character generator	Chrono-Log	92,131-3-11	820696
Video character generator	Chrono-Log	92,131-3-11	810697
Wide angle TV lens	Vicon	None	12386
Wide angle TV lens	Vicon	None	12493
Wide angle TV lens	Vicon	None	81351
Wide angle TV lens	Vicon	None	82537
20 channel reproducer	Magnasync/Moviola	TP2020	110004
Time code generator	Magnasync/Moviola	TAC601/2	2142
Feedback controller	Shure	M610	None
TV monitor,color,19"	NEC	C19-709A	1780491
TV monitor,color,19"	NEC	C19-709A	1781341
Cordless microphone	Cetec/Vega	112	7540
Microphone,area	AKG	D1000E	None
Microphone,area	AKG	D1000E	None
Microphone,area	AKG	D1000E	None
Microphone,area	AKG	D1000E	None

APPENDIX E

CONTRACTOR PURCHASED EQUIPMENT

This appendix contains a list of equipment purchased for the account of the government by SAIC under Contract No. MDA903-81-C-0254.

BATTALION TASK FORCE COMMANDER

The following functions represent the major activities of the Battalion Task Force Commander. They are based on those found in FM 71-2 and ARTEP 71-2. In column A indicate with a check mark if the functions were performed, by unit if appropriate. In column B evaluate the overall performance of those functions using a scale of one to five with one being poor; two, below average; three, average; four, above average; and five, excellent.

		A	B
1.	COMMANDER PLANNING		
1.1	Issue warning order	___	
1.2	Analyze and, if necessary, restate mission	___	
1.3	Request additional information	___	
1.4	Identify mission-essential tasks	___	
1.5	Make assumptions, if necessary	___	
1.6	Develop and announce tentative concept of operation and scheme of maneuver	___	
1.7	Identify and announce tentative courses of action	___	
1.8	Identify and tentatively allocate available resources	___	
1.9	Announce known restrictions	___	
1.10	Call for staff estimates	___	
	Commander Planning Evaluation		___
2.	COMMANDER'S ESTIMATE		
2.1	Analyze mission (detailed)	___	

		A	B
2.2	Analyze situation and courses of action (including staff input)	___	
	Area of operations ___ Enemy situation ___ Friendly situation ___ Relative combat power ___ Courses of action ___		
2.3	Analyze courses of action	___	
	Enemy capabilities ___ Course of action #1 ___ Course of action #2 ___ Course of action #3 ___		
2.4	Compare courses of action	___	
	Course of action #1 vs #2 ___ Course of action #1 vs #3 ___ Course of action #2 vs #3 ___		
2.5	Decide course of action	___	
	Commander's Estimate Evaluation		___
3.	COMMANDER COORDINATION		
3.1	Orchestrate staff planning and operation	___	
	S1 ___ S2 ___ S3 ___ S4 ___ Comm O ___ Engr ___		
3.2	Coordinate with brigade	___	
3.3	Coordinate with adjacent units	___	
	Right adjacent ___ Left adjacent ___		
3.4	Coordinate with supporting units	___	
	Artillery ___ Engineer ___ Aviation ___ Other ___ ___		

		A	B
3.5	Coordinate with subordinate units	___	
	HHC A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___		
	Commander Coordination Evaluation		___
4.	COMMANDER SUPERVISION		
4.1	Actively monitor situation	___	
	Seek information ___ Transmit information ___ Personally observe ___		
4.2	Assess battle progress	___	
4.3	Revise battle plan (scheme of employment)	___	
4.4	Reallocate resources; assign priorities	___	
4.5	Issue orders	___	
	Supervise Execution Evaluation		___

RECAPITULATION

	Evaluation
COMMANDER PLANNING	______
COMMANDER'S ESTIMATE	______
COMMANDER COORDINATION	______
COMMANDER SUPERVISION	______
BATTALION TASK FORCE COMMANDER EVALUATION	______

(Note: Do not sum evaluations and divide by 4, but weight the functions by their importance and evaluate the Battalion Task Force Commander accordingly.)

S1 SECTION

The following functions represent the major activities of the S1 section. They are based on those found in FM 71-2 and ARTEP 71-2. In column A indicate with a check mark if the functions were performed, by unit if appropriate. In column B evaluate the overall performance of those functions using a scale of one to five with one being poor; two, below average; three, average; four, above average; and five, excellent.

		A	B
1.	PERSONNEL ESTIMATE		
1.1	Prepare estimate and present to commander (written or oral)	___	
1.2	Update estimate as battle progresses; coordinate with S3 and commander on serious personnel deficiencies.	___	
1.3	Coordinate with S3 on anticipated casualties during operation.	___	
	<u>Personnel Estimate Evaluation</u>		___
2.	PERSONNEL STATUS		
2.1	Maintain personnel status; receive and process status reports; seek information where necessary HHC ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___	___	
2.2	Coordinate personnel status with TF CO ___ S3 ___ S4 ___ Bde ___	___	
2.3	Prepare and transmit PDS to Bde as prescribed by Op order or SOP (verbal or message center)	___	
	<u>Personnel Status Evaluation</u>		___

		A	B
3.	CASUALTY REPORTS		
3.1	Receive and process casualty reports; seek casualty information as necessary and as dictated by situation HHC ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___	___	
3.2	Transmit information of unusual casualty situations to TF CO ___ S3 ___ Bde ___	___	
	<u>Casualty Report Evaluation</u>		___
4.	REPLACEMENTS		
4.1	Maintain critical MOS file	___	
4.2	Request/requisition replacements; monitor response to requisitions	___	
4.3	Coordinate with S3 on assignment of replacement	___	
4.4	Notify units of availability and number of replacements plus anticipated time of arrival	___	
4.5	Coordinate with S4 on transportation of replacements to units	___	
	<u>Replacements Evaluation</u>		___
5.	PRISONERS OF WAR		
5.1	Select PW collecting point; notify HHC ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___	___	
5.2	Coordinate with S2 on PW interrogation point	___	
5.3	Coordinate with CO, HHC on operation and security of PW collecting point	___	

		A	B
5.4	Coordinate with S4 for PW evacuation	___	
5.5	Coordinate with medical platoon leader for PW medical care	___	
5.6	Coordinate, monitor, and supervise PW processing	___	
	<u>Prisoners of War Evaluation</u>		___
6.	MEDICAL SUPPORT		
6.1	Develop medical plan in coordination with medical platoon leader	___	
6.2	Select location of battalion aid station in coordination with medical platoon leader	___	
6.3	Notify subordinate units of medical support facilities and capabilities HHC ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___	___	
6.4	Monitor treatment and evacuation of patients to division clearing station and/or corps combat support hospital	___	
	<u>Medical Support Evaluation</u>		___
7.	PERSONNEL SUPPORT (as applicable) Provides for		
7.1	Distribution of command information (Op order or SOP)	___	
7.2	Mail (Op order or SOP)	___	
7.3	Religious services (Op order or SOP)	___	
7.4	Discipline, law, and order (Op order or SOP)	___	
7.5	Processing awards (SOP)	___	
7.6	Pay (SOP)	___	
7.7	Leaves and passes (Op order or SOP)	___	
7.8	Post exchange (Op order or SOP)	___	
7.9	Other (legal, welfare, et al) (SOP)	___	
	<u>Personnel Support Evaluation</u>		___

		A	B
8.	GRAVES REGISTRATION		
8.1	Select the graves registration collecting point; notify companies of graves registration collection point HHC ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___	___	
8.2	Coordinate with S4 for transportation to evacuate the dead HHC ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___	___	
	<u>Graves Registration Evaluation</u>		___

RECAPITULATION

	Evaluation
PERSONNEL ESTIMATE	______
PERSONNEL STATUS	______
CASUALTY REPORTS	______
REPLACEMENTS	______
PRISONERS OF WAR	______
MEDICAL SUPPORT	______
PERSONNEL SUPPORT	______
GRAVES REGISTRATION	______
S1 SECTION EVALUATION	______

(Note: Do not sum evaluations and divide by 8, but weight the functions by their importance and evaluate the S1 section accordingly.)

S2 SECTION

The following functions represent the major activities of the S2 section. They are based on those found in FM 71-2, ARTEP 71-2, and FM 30-5. In column A indicate with a check mark if the functions were performed, by unit if appropriate. In column B evaluate the overall performance of those functions using a scale of one to five with one being poor; two, below average; three, average; four, above average; and five, excellent.

		A	B
1.	INTELLIGENCE ESTIMATE		
1.1	Analyze area of operation, terrain, and weather	___	
1.2	Analyze enemy situation	___	
1.3	Enumerate enemy capabilities	___	
1.4	Identify probable enemy course of action	___	
	<u>Intelligence Estimate Evaluation</u>		___
2.	COLLECTION PLANNING		
2.1	Identify essential elements of information (EEI)	___	
2.2	Identify information collection capabilities	___	
	Scouts ___		
	Patrols ___		
	GSR ___		
	SLAR ___		
	IR ___		
	MTI ___		
	Emission Detector ___		
	Other ___		
2.3	Prepare collection plan	___	

		A	B
2.4	Task collection agencies	___	
	Brigade ___ HHC/1/77 ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___ Adjacent Units ___ Other ___		
2.5	Prepare surveillance and target acquisition plan	___	
	<u>Collection Planning Evaluation</u>		___
3.	INTELLIGENCE OPERATIONS		
3.1	Monitor and supervise the collection effort	___	
3.2	Process intelligence information	___	
	Record information ___ Evaluate information as to source and quality ___ Interpret significance ___		
	<u>Intelligence Operations Evaluation</u>		___
4.	INTELLIGENCE DISSEMINATION AND COORDINATION		
4.1	Disseminate and coordinate staff	___	
	Commander ___ S1 ___ S3 ___ S4 ___ Other ___		
4.2	Disseminate and coordinate subordinate units	___	
	HHC ___ Scouts ___ A/1/77 ___ B/1/77 ___ B/1/3 ___ C/1/3 ___ CSC/1/77 ___ Other ___		

		A	B
4.3	Disseminate and coordinate higher and adjacent units	___	
	<u>Dissemination Evaluation</u>		___
5.	SECURITY AND COUNTERINTELLIGENCE		
5.1	Develop and implement security plan	___	
5.2	Develop and implement counterintelligence plan	___	
	<u>Security and Counterintelligence Evaluation</u>		___

RECAPITULATION

	Evaluation
INTELLIGENCE ESTIMATE	________
COLLECTION PLANNING	________
PROCESS INTELLIGENCE INFORMATION	________
DISSEMINATE AND COORDINATE INTELLIGENCE INFORMATION	________
SECURITY AND COUNTERINTELLIGENCE	________
S2 SECTION EVALUATION	________

(Note: Do not sum evaluations and divide by 5, but weight the functions by their importance and evaluate the S2 section accordingly.)

S3 SECTION

The following functions represent the major activities of the S3 section. They are based on those found in FM 71-2 and ARTEP 71-2. In column A indicate with a check mark if the functions were performed, by unit if appropriate. In column B evaluate the overall performance of those functions using a scale of one to five with one being poor; two, below average; three, average; four, above average; and five, excellent.

		A	B
1.	OPERATION ESTIMATE		
1.1	Analyze mission	___	
1.2	Analyze situation and courses of action	___	
	Area of operations ___ Enemy situation ___ Friendly situation ___ Relative combat power ___ Courses of action ___		
1.3	Analyze courses of action	___	
	Enemy capabilities ___ Course of action #1 ___ Course of action #2 ___ Course of action #3 ___		
1.4	Compare courses of action	___	
	Course of action #1 vs #2 ___ Course of action #1 vs #3 ___ Course of action #2 vs #3 ___		
1.5	Recommend course of action	___	
	<u>Operations Estimate Evaluation</u>		___

		A	B
2.	OPERATIONS PLANNING		
2.1	Plan execution	___	
	Concept ___ Scheme of maneuver ___ Scheme of fires ___ Other ___		
2.2	Develop task organization	___	
2.3	Assign missions	___	
	Maneuver units ___ Reserve ___ Fire support ___ Engineer ___ EW ___		
2.4	Develop and announce coordinating instructions	___	
	Effective date/time ___ Priorities ___ Control measures ___ Restrictions ___ Special instructions ___ EEI ___		
2.5	Develop combat service support plan	___	
	Supply ___ Maintenance ___ Transportation ___ Services ___ Other ___		
2.6	Develop command and signal plan	___	
	Command post ___ Alternate CP ___ Axis of operations ___ CEOI ___ Other ___		
	<u>Operations Planning Evaluation</u>		___

		A	B
3.	OPERATIONS COORDINATION		
3.1	Coordinate with S1	___	
	Unit strengths/status ___		
	Key personnel status ___		
	Replacements ___		
	CP locations and displacement ___		
3.2	Coordinate with S2	___	
	Organization of TOC ___		
	Intelligence situation ___		
	Area of operations ___		
	Target acquisition ___		
	Counterintelligence ___		
	EW ___		
	EEI ___		
3.3	Coordinate with S4	___	
	Status of CSS ___		
	CSS requirements ___		
	Priorities for CSS ___		
	Location of Bn Trains ___		
	Supply routes ___		
3.4	Coordinate combat support	___	
	Fire support ___		
	Close air support ___		
	Engineer support ___		
	Psy war support ___		
	NBC support ___		
	Air defense ___		
3.5	Coordinate with brigade	___	
	Operations info ___		
	Combat support ___		
3.6	Coordinate with subordinate units	___	
	HHC ___		
	A/1/77 ___		
	B/1/77 ___		
	B/1/3 ___		
	C/1/3 ___		
	CSC/1/77 ___		
	Engr ___		
	<u>Operations Coordination Evaluation</u>		___

		A	B
4.	TACTICAL OPERATIONS		
4.1	Prepare and issue Op O/Frag O	___	
	Timely preparation ___		
	Coordinated ___		
	Complete ___		
	Timely distribution ___		
4.2	Monitor, supervise, and recommend tactical operations	___	
	Concept of operations ___		
	Scheme of maneuver ___		
	Task organization ___		
	Missions ___		
	Control/coordination ___		
	Combat support ___		
	Combat service support ___		
	Priorities ___		
4.3	Supervise TOC operations	___	
	Tactical Operations Evaluation		___

RECAPITULATION

	Evaluation
OPERATION ESTIMATE	______
OPERATION PLANNING	______
OPERATIONS COORDINATION	______
TACTICAL OPERATIONS	______
S3 SECTION EVALUATION	______

(Note: Do not sum evaluations and divide by 4, but weight the functions by their importance and evaluate the S3 section accordingly.)

S4 SECTION

The following functions represent the major activities of the S4 section. They are based on those found in FM 71-2 and ARTEP 71-2. In column A indicate with a check mark if the functions were performed, by unit if appropriate. In column B evaluate the overall performance of those functions using a scale of one to five with one being poor; two, below average; three, average, four, above average; and five, excellent.

		A	B
1.	LOGISTICS ESTIMATE		
1.1	Analyze situation	___	
	Personnel ___		
	Intelligence ___		
	Operations ___		
	Logistics ___		
1.2	Analyze Logistics factors	___	
	Area of operations ___		
	Supply ___		
	Maintenance ___		
	Transportation ___		
	Services ___		
	Facilities ___		
1.3	Identify and analyze logistics courses of action	___	
	<u>Logistics Estimate Evaluation</u>		___
2.	LOGISTICS PLANNING		
2.1	Plan supply of units	___	
	Distribution (unit or supply points) ___		
	Prescribed loads ___		
	Cl I DP or Sup Pt ___		
	Cl III DP or Sup Pt ___		
	Cl V ASP ___		
	Other ___		

			A	B
2.2	Plan transportation		___	
	Combat support	___		
	Combat service support	___		
	MSR	___		
	Controls (circulation, TCPs)	___		
	Other	___		
2.3	Plan services		___	
	Water supply points	___		
	Bath points	___		
	Salvage collection point	___		
	Clothing exchange	___		
	Decontamination point	___		
	Other	___		
2.4	Plan maintenance		___	
	Battlefield recovery	___		
	Evacuation policy	___		
	Contact teams	___		
	Other	___		
2.5	Plan security		___	
	Combat trains	___		
	Field trains	___		
	Logistics Plans Evaluation			___
3.	LOGISTICS COORDINATION			
3.1	Coordinate with S1		___	
	Personnel status	___		
	Transportation	___		
	PW	___		
	Graves registration	___		
	Medical evacuation	___		
3.2	Coordinate with S2		___	
	Analysis of area	___		
	Enemy capabilities	___		
	Security operation	___		
	Counterintelligence	___		

		A	B
3.3	Coordinate with Commander/S3	___	
	Concept of operations/ scheme of maneuver ___		
	Priorities for support ___		
	Prescribed loads ___		
	Transportation (CS) ___		
	Supply routes ___		
	Trains location(s) ___		
3.4	Coordinate with other battalion staff	___	
	Comm O ___		
	Motor O ___		
	ENG O ___		
3.5	Coordinate with brigade	___	
	General support ___		
	MSR, controls ___		
	Brigade and division logistics installations ___		
3.6	Coordinate with subordinate units	___	
	HHC ___		
	A/1/77 ___		
	B/1/77 ___		
	B/1/3 ___		
	C/1/3 ___		
	CSC/1/77 ___		
	Engr ___		
	<u>Logistics Coordination Evaluation</u>		___
4.	LOGISTICS OPERATIONS		
4.1	Monitor, supervise, and adjust logistics operations	___	
	Supply ___		
	Maintenance ___		
	Transportation ___		
	Services ___		
	Other ___		
4.2	Supervise battalion trains	___	
	Combat trains ___		
	Field trains ___		
	<u>Logistics Operations Evaluation</u>		___

RECAPITULATION

	Evaluation
LOGISTICS ESTIMATE EVALUATION	________
LOGISTICS PLANS EVALUATION	________
LOGISTICS COORDINATION EVALUATION	________
LOGISTICS OPERATIONS EVALUATION	________
S4 SECTION EVALUATION	________

(Note: Do not sum evaluations and divide by 4, but weight the functions by their importance and evaluate the S4 section accordingly.)

DETAILED COMMENTS:

Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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Paragraph __.__ ____________________

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APPENDIX G

MACE INSTRUMENTATION AND FEEDBACK

This appendix contains a memorandum for record of a meeting between government personnel and SAIC which established guidelines for the development of the MACE feedback package.

INTER-OFFICE MEMO

MEMORANDUM FOR RECORD

SCIENCE APPLICATIONS, INC.

DATE: June 27, 1983

TO: ______________________ FROM: Charles F. Carter, Jr.

SUBJECT MACE Instrumentation and Feedback

The following personnel met at Battle Simulations Division, Funston Hall, Fort Leavenworth, at 1330 hours, 24 June 1983.

LTC R. Koontz
MAJ D. Sipe, CGSC
CPT A. Mourfield, OTSD
Mr. T. Venne, OTSD
Dr. H. Barber, ARI
Mr. R. Solick, ARI
Mr. C. Carter, SAI
Dr. M. Patton, SAI

Two principal topics were discussed; namely,

- MACE Instrumentation
- MACE Feedback Package

MACE Instrumentation. The discussion of instrumentation of MACE simulation exercises centered on providing equipment and an associated feedback capability which would be used with all MACE facilities to be installed worldwide (48). A major theme of the discussion made clear the position that BSD (CGSC) and OTSD (CAORA) do not wish to acquire equipment which would not become part of a standard set of MACE equipment. The target of this position is the 20-channel audio recorder and its associated audio time code generator and audio distribution amplifiers. The elimination of the 20-channel audio recording system would result in a cost savings of approximately $10,200, which could then be diverted to a satisfactory alternative audio recording system. The discussion did not, however, rule out the acquisition of the 20-channel recorder if it could be justified as contributing to the development of the MACE simulation as a worldwide training system.

Consideration of alternative solutions for audio recording of five communications channels is necessary so as to provide the participating battalion command group with a take home feedback package which would include both video and audio

recordings of the MACE exercise. Topics of recording and home-station playback of both audio and video tapes, the use of ½ inch versus 3/4 inch video tapes for recording, the voice activation (actuation) of audio recordings, and the synchronization (time coding) of audio and video recordings were discussed in connection with instrumentation alternatives. It appeared to be the consensus that the best alternative was to record five communication nets on the alternate channels of video cassette recorders and thus provide the battalion commander with a set of video tapes as a major element of his feedback package.

Additional discussion addressed the subject of including on one of the video tapes a 15-second recording of the battle situation at either 4 minute, 8 minute, or 12 minute intervals. (The battle situation is updated for large screen display every 4 minutes). The battle situation would then be directly relatable to battalion command group activities.

MACE Feedback Package. Optional feedback packages were discussed with Major Sipe, and it was agreed that the following package components were desired:

- MACE will record exercises on ½ inch video tape (to include dual audio channel recording as discussed above) and will deliver an unedited tape to the participating battalion command group.

- MACE will deliver exercise beginning and ending personnel and equipment status reports for friendly and OPFOR units, plus half-hourly personnel and equipment status reports. Force dispositions will be provided on the video tape at 4, 8, or 12 minute intervals.

- MACE will provide terrain maps and brigade overlays for the simulation exercise. The battalion command group will prepare and retain battalion overlays.

- MACE will supply the written brigade operation order. The battalion command group will prepare and retain any written battalion order. Battalion verbal orders will be recorded on video tape.

- MACE will make battle outcome calculations for delivery to the participating battalion command group. As battle outcomes are accumulated, MACE may supply battalion outcome comparisons.

- MACE will provide a written suggested guide for battalion self-evaluation of exercise performance. When pre-arranged by the participating battaion, MACE may prepare a written evaluation of the performance of a selected staff section(s). These evaluations should be keyed to ARTEP evaluation criteria.

CFC:j

PB-85-87
Leavenworth
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Working Paper FLV ~~FU~~ 85-2

DESIGN OF A MODULAR LABORATORY FOR RESEARCH ON TACTICAL C^2 (ABRIDGED VERSION)

L.M. Crumley (Ed.) *
R.V. Tiede **
H.F. Barber *
P.E. McKeown**
R.R. Michel *
R.E. Solick *
S.R. Stewart *
S. Struefert **

* ARI FIELD UNIT AT FORT LEAVENWORTH, KANSAS
** SCIENCE APPLICATIONS, INC.

February 1985

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333

85-2520

PREFACE

In 1983 the Military Sciences Operation of Science Applications, Inc. (SAI), submitted their final report on an Army Research Institute (ARI) funded contract to determine the requirements for a laboratory which could do research on command and control problems within the resource constraints of ARI.

The SAI report, including Appendices, contained 297 pages and much of the material which contributed to the reports size was primarily of a background or project historic nature. ARI opted therefore, to create this abridged version which contains the material which deals with the development and description of command and control research areas. The abridged version was created by deleting sections, and parts of sections, from the original SAI report. Brief summaries of the deleted material were put in place of the original sections. The following changes were made in the original SAI document:

a. Table of Contents including the full List of Figures and List of Tables has been retained. Omitted material, including Figures and Tables, has been marked.

b. Section 1, Section 1.1 Purpose was rewritten. The balance of the Introduction was retained.

c. Section 2, Planning Guidance (29 pages) was deleted and replaced with a one and one half page summary.

d. Section 3, A Review of Research Methods Relevant to C^2 Settings (59 pages) was deleted and replaced with a one and one half page summary.

e. Section 4, A Review of Decision Laboratory Techniques and Designs Relevant to C^2 Research (35 pages) was deleted and replaced with a one page summary.

f. Section 5, Develop Detailed C^2 Simulation Laboratory Design Specifications (43 pages). The first 25 pages, which included 7 tables, were retained. The final 17 pages, which included 12 additional tables, were deleted and replaced with a one page summary.

g. Section 6, Plan for Implementing the C^2 Simulation Laboratory. The section was deleted.

h. Appendix A. List of References. The reference list which supported the material in Section 3 of the original report was deleted.

i. Appendix B. The appendix (28 pages) supports Section 5.2 of the original report. It details the kinds of research which needs to be accomplished in command and control and relates hardware/software requirements to dependent and independent variables. The appendix was included in its entirety.

j. Appendix C. The appendix (62 pages) supports Section 5.3 of the original report. It details the development of the research classification scheme described in Section 5 and provides additional matching of research parameters to hardware/software factors. The appendix was included in its entirety.

The purpose of the abridgement was to create a shorter report that deals more specifically with the behavioral and social science parameters which are important in command and control research and show how these parameters relate to the complex laboratory facilities in which the issues would need to be researched. By removing the background material that dealt with the process of defining a research facility based on research requirements the abridged report was reduced to 140 pages.

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* Indicates sections changed or omitted and summarized.

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* Indicates Figure omitted.

LIST OF FIGURES (Cont'd)

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* Indicates Tables omitted.

Section 1

INTRODUCTION

1.1 PURPOSE

The report which served as a basis for this abridgement was the product of a contract research effort which had as one of its goals the orderly evaluation of those factors which dictate and constrain the development of a dedicated command and control research facility. The factors which affect research facility requirements fall generally into three areas: (1) the Army's status and plans for C^2 development, (2) the behavioral science aspects of the C^2 process, and (3) the resources available to create a C^2 facility.

The Army is moving rapidly to create C^2 systems which utilize the advances in data handling and information processing made possible by computer technology, so it is imperative that a C^2 laboratory be able to cope with a research program which is based largely on a computer technology driven set of variables. It is also necessary to address behavioral variables which encompass a range of factors dealing with both individual and team data processing and decision making processes.

Both of these general areas impose conditions, on research requirements, which have the effect of making research facility requirements complex and expensive. Resources available to develop a C^2 laboratory are, of course, finite and, therefore care must be taken to assure that available resources are wisely allocated. The report, from which this shortened version is derived, had as its primary purpose the description of the impact of these two areas on facility requirements and definition of a facility procurement strategy that would obtain maximum benefit from limited resources. The purpose of this abridged version of the report is to disseminate portions of the original report which are important even though ARI has decided on a laboratory acquisition strategy which differs significantly from the incremental development process recommended in the full report.

1.2 NEED

Two projections of the nature of future combat combine to emphasize the necessity for reducing C^2 timelines and increasing the accessibility and accuracy of the data base used for decision making. The first is the extension of the battlefield both in-depth and forward in the time dimension as described in TRADOC Pamplet 525-5 (1981). The second is the projection of future battle dynamics set forth in TRADOC's "Airland 2000 (U)." Extension of the battlefield in-depth visualizes engagement of enemy units not in contact, combined with extensions in time such that actions are correlated with the attack of follow-on echelons, logistical preparations, and maneuver plans, all of which are, in turn, interrelated. A further factor in this combination is an increased emphasis on higher-level Army and sister-service acquisition means and attack resources, and the close coordination required to maximize the effectiveness of these "scarce" assets in terms of payoff in the close-in battle. Attacks against follow-on echelons are made with the objective of creating "windows for action" during which friendly superiority exists and the initiative can be seized with enough time to act. Recognition of the "windows" created, execution of these attacks, and execution of coordinated actions at the FLOT combine to present a monumental C^2 problem for which every possible assistance must be provided to the commander.

"Airland 2000 (U)" projects a future integrated battlefield characterized by high engagement frequency, rapid movement for dispersion and concentration, a 360^{o} battle, fleeting targets and rapidly changing situations. It further notes that *the enemy will be defeated by the failure of his C^2 to keep pace* (emphasis added). Soviet activities in the field of automated C^2 systems cannot be ignored in this context.

The critical element inherent in both of these projections is that of time. Always a driving factor in military operations, time is even more crucial given the current and projected Soviet superiority in combat power. Essential to the success of US forces is the ability to disrupt the flow of that combat power and strike quickly given favorable conditions. This clearly implies recognition, coordination and decision processes which are beyond the capability of current procedures to execute on a sustained basis. Also implied are *continuous* calculations--movement times for forces of both sides, force ratios, damage predictions, fire plan coverage, logistical requirements, and so on--for numerous courses of action, repeated at frequent intervals. Failure to properly monitor these fundamental relationships and requirements can negate timely recognition of an opportunity and/or the ability to capitalize when presented. It is through such calculations that the opportunity can be anticipated rather than reacted to.

This need for improved timeliness and quality in tactical decision making leads directly to the following basic goals for the C^2 system:

1. Reduce timelines throughout the tactical C^2 system, but especially the response times of the decision making nodes (TOCs).

2. Improve the capability to "manage uncertainty," i.e., provide decision aids which facilitate selection of alternatives with the highest probability of success.

3. Reduce the uncertainty of the data base (basis for decision making) through better management of data collection and processing.

There is one other dimension to this problem, that of C^2 system readiness. The cited projections of future combat do not visualize the relatively slow buildup of combat intensity which has characterized US participation in past wars. Instead, they project highly dynamic and intense conflict immediately after the onset. This means that not only must the C^2 system be in place, but it must have achieved the goals outlined above prior to hostilities.

In this connection it is interesting to recall how staffs have historically been organized and trained. The ultimate source of information on command and staff duties, responsibilities, and major functions is, of course, the Staff Officer's Field Manual, FM 101-5. It describes in some detail what has to be done. The appropriate Table of Organization and Equipment (TOE) lists the assets (i.e., people, skills and equipments) authorized to perform the tasks prescribed by FM 101-5. The ARTEPS provide a set of performance standards for C^2 tasks. The individuals comprising the staff have (hopefully) been qualified in their Military Occupational Specialty (MOS) and the senior staff members have been taught military decision making techniques such as the estimate. However, none have been given formal guidance on how to structure a staff or how to organize the information flow. Nor does the doctrinal literature provide much guidance on how to carry out the doctrinally prescribed tasks other than for a few formats for the major staff products and what can be inferred from MOS specified skills. The US Army has been reluctant to tread on a commander's prerogatives by specifying or even examining in any detail the procedures used by staffs in carrying out their assigned tasks. Time and motion studies have been fine for crew-served weapon teams or even for fire direction and fire control centers, but not for command posts.

When the elements of the staff are assembled on those rare occasions when they have an opportunity to carry out their wartime tactical functions they follow the same pattern of development followed by other free-form groups in structuring their activities. This has been well expressed by Katz (1982):

> One of the more important principles in organizational theory is that groups strive to structure their work environments to reduce the amount of stress they must face by directing their activities toward a more workable and predictable level of certainty and clarity (Thompson, 1957; Pfeffer, 1981). Based on this perspective, project members interacting over a long period will develop standard work patterns that are familiar and comfortable, patterns in which routine and precedent play a relatively large part. Weick (1969), for example, discusses the strong tendency for groups to establish certain stable structures of interlocked behaviors and relationships simply because it keeps them feeling secure and confident in what they do. ....It is further argued that as group members continue to interact and build a history with one another, a more homogeneous set of understandings about the group and its environment will develop through informational social influence (Homans, 1961; Berger and Luckman, 1966; Salancik and Pfeffer, 1978). Group homogeneity can come either from similarity of social backgrounds and characteristics or from group members remaining in their project positions long enough to make shared socialization and shared group experiences a meaningful basis of mutual support (Grusky, 1964; Kanter, 1977). Such shared meanings not only provide group members with a strong sense of identity but also demarcate the group from other entities both within and outside the organization, leading to further reductions in the group's overall level of outside contact.

Such evolutionary development of staff organizations and procedures was probably best exemplified in WWII which was the last period during which the US Army developed a large number of higher level staffs. Not only did senior commanders have substantial latitude in selecting their senior staff personnel, but such groups, once formed, were

allowed to remain together and frequently moved as a group to higher echelons when the commander was promoted. Moreover, there was time and opportunity for these staffs to evolve and hone their procedures and skills in truly large scale maneuvers and field exercises--on a scale possible only under the threat of national survival. Such an evolutionary approach to building staffs is no longer feasible.

The Army is, therefore, faced with the dual problem of:

(1) Training staffs to significantly higher levels of responsiveness and competence than has been heretofore required, and

(2) Training staffs to that level of proficiency in peacetime.

In order to reach those goals the Army must do the research needed to gain a better understanding:

- Of what and how information is used in tactical decision making--how information should be aggregated and transferred to decision makers so that <u>all</u> available pertinent but <u>only</u> pertinent information is used in decision making, what kinds of decision aids can and should be provided to speed and improve human decision making.
- Of how to apply this knowledge in the design of C^2 systems where such systems are comprised of people, hardware, and software.
- Of the tools and methods that are most effective in training commanders and staffs to reach the required level of proficiency most quickly and to maintain those standards in peacetime.

The proposed C^2 research laboratory would assist ARI and TRADOC in achieving these ends.

Section 2

SUMMARY OF SECTION II (PLANNING GUIDANCE SUBTASKS 2.1 AND 2.2)

Section II of the report provides a relatively extensive discussion of the contractors interpretation and understanding of the planning guidance received in the various meetings between SAI and ARI personnel. The intent of this section of the document is defined as:

o To outline a set of issues deemed important for investigation in a C^2 laboratory and known general considerations and constraints which must be taken into account in its design.

o To provide an initial concept of the physical layout of the laboratory and its contents in terms of generic items of equipment.

C^2 research requirements are considered as falling into three categories: (1) individual decision/information processing/problem solving behavior research, (2) multiple individual or team decision/information processing/problem solving behavior research, (3) automation aids development and experimentation. FOR Class I the report indicates that typical dependent variables could include such items as:

Information Load,
Information Verdicality,
Decision Making Characteristics,
Time Pressure,
Decision Type,
Information Organization, and
Symbology

The report also notes that dependent variables would likely be such things as measures of the subjects perception of the situation, decision quality, impact of performance on "battle" outcome, and the nature and frequency of communication errors.

For Class II experiments where subjects are involved as groups the same independent variables were considered relevant but certain types of group specific parameters were also noted. Modes of interaction, division of labor alternatives group decision making characteristics or style, alternative procedures and Ad Hoc vs. Non Ad Hoc groups were suggested as additional variables of interest. Dependent variables were perceived as remaining the same but having additional group related problems and significances.

Class III experiments which deal with the development and evaluation of decision aids were not discussed in much detail. It was only noted that the development and efficacy evaluation would need to be applied to both ARI developed and non-ARI developed aids that a suitable proving process might require follow-up research in a field setting.

The section also addresses training and training vehicle research requirements. It notes that questions concerning simulation fidelity, diagnostics and trainee feedback, training techniques, effectiveness measurement, training for automated vs. manual systems, controller functions, automated controller functions and the potential of evolving technological areas, e.g., more interactive devices, all represent potential research parameters.

The remainder of the 29 page section consists of discussions of the characteristics that a laboratory in which the types of research discussed above could be conducted.

Section 3

SUMMARY OF SECTION III, (A REVIEW OF RESEARCH METHODS RELEVANT C^2 SETTING

This section, of 59 pages, constitutes a rather general review of portions of the Command and Control literature. Titles were obtained from the considerable personal knowledge of the research team - SAI and ARI - and from the results of a PASAR search. The search covered material published in English, French, and German which used adults as subjects in the 1972-1982 time period. The search covered the following key words:

<u>Independent Variables</u>

- Research Methods
- Simulations
  - Computer Simulations
  - Manned Simulations
  - Man Machine Simulations
- Experiments (experimentation)
  - Natural Experiments (experimentation)
  - Field Experiments (experimentation)
  - Laboratory Experiments (experimentation)
  - Quasi-Experiments (experimentation)
  - Computer Models (modeling)
  - In-Basket Techniques
  - Role Playing

Dependent Variables

Command

Control

Communication

C^2, C^3

Performance

Decision-Making

Task Success

Task Performance

The PASAR search obtained 2124 citations and abstracts. Based on the reading of those abstracts, some 164 articles, chapters, or books were selected for further review. The material in the section is based on these publications and the additional literature available to the authors. (Appendix A, which is omitted from this abridged version, contained a total of 152 references).

The section discusses the literature in the context of the 41 subtopics noted in the Table of Contents under Section 3. The Section is primarily of historic interest in that it formalizes a rationale concerning the C^2 important topics which influenced the laboratory design process.

Section 4

SUMMARY OF SECTION IV. (A REVIEW OF DECISION LABORATORY TECHNIQUES AND DESIGNS RELEVANT TO C^2 RESEARCH)

This section, of 35 pages, reviewed factors which the authors felt were particularly relevant in determining the size required for a facility designed and dedicated to command and control research. The section notes that the literature search had not identified a single laboratory designed specifically for command and control research. Instead such research tended to be conducted in facilities created for other purposes such as training simulators. The section specifies seven factors which needed to be considered in designing a research facility. The factors were identified as:

Military Echelon,
Size of Subject Group,
Decision Tasks and Scenarios,
Instrumentation,
Simulation Configuration,
Decision Modules, and
Generating a Credible Information Stream

In discussing "Military Echelon," from corps to battalion and "Size of Subject Group" the report briefly described the differing characteristics of the four echelons. It notes that corps staffs are large (several hundred individuals) and their planning activity deals with events that will occur up to 96 hours in the future whereas battalion staffs are very much smaller and generally deal with events likely to occur over the next three or four hours.

Thus, the size of the laboratory, which for practical reasons must be finite in size, limits the number of subjects which can be run. This in turn creates a situation where the extent of the C^2 operation being researched must be limited. Thus, the laboratory can address reasonably large portions of a battalion C^2 structure but only very small parts of a corps structure.

The section also briefly discusses the problem of creating suitable scenarios for research in the decision tasks arena and moves on to discuss, in general terms, the problems of instrumenting and configuring a C^2 research laboratory, the need to achieve flexibility by using a modular configuration approach, and the need to create a realistic representation of the information and information-flow into C^2 operations.

Section 5

DEVELOP DETAILED C^2 SIMULATION LABORATORY DESIGN SPECIFICATIONS - SUBTASK 2.5

5.1 INTRODUCTION

The effort described in the preceding four subtasks amounts to a survey and analysis of research areas to be investigated, experimental techniques applicable to C^2 research, and appropriate laboratory component design and configuration. This has bounded the problem and insures that the overall top-down design will encompass all of the probable applications without requiring major redesign. The next effort is to synthesize this information and to fashion it into a description of a series of modules which are sized into doable and fundable packages and which are prioritized according to their anticipated utility. Our approach to this problem was to consider it as a typical resource allocation problem with multiple objective functions and multiple constraints. The problem was solved in five steps as follows:

- The laboratory requirements described in Section 2 (Planning Guidance) were structured into a series of experiment classes which became the building blocks (program elements) for the rest of the development.
- The necessary laboratory functions and interfaces were then identified by means of the N^2 chart technique.
- Identification of functions and interfaces permitted definition of needed hardware and software elements.
- A priority for sequencing the experiment classes and a projected funding profile were obtained from the sponsor.
- Finally a five year procurement program was developed.

5.2 LABORATORY REQUIREMENTS STRUCTURE

The various requirements stated in Section 2 were arrayed according to the eight dimensions in which they were described. These were:

- Type Research: Three different types of research are described in Section 2: command control research, training research and controller research.

- Category: Three categories of experiments are described: single subject experiments, multiple subject experiments and experiments with automated aids.

- Data Base: Three different kinds of data bases are described. These include:

  - STATIC DATA BASE. Description of a tactical situation at a specified instant in time, as it might be perceived by one opponent (environmental, friendly and enemy). This information could include not only current values (e.g., locations, strengths, logistic levels) but also historical data, rates of change, or anticipated future levels, as appropriate. This could be generated from a time slice of the computer log tape of a prior combat simulation. The static data base is particularly applicable to planning activities by the subject since his actions (decisions) have no immediate effect on the ongoing battle.

  - MOVING DATA BASE. A continuing description of an emerging tactical situation but with which the subject cannot interact. This is most easily generated from the log tape of a completed combat simulation. The moving data base is particularly applicable to what were described as experimental simulations in Section 3.

  - INTERACTIVE DATA BASE. A continuing description of an emerging tactical situation which does reflect actions (decisions) taken by the subject. In general, this requires an operating combat outcome generator and is applicable to what were described as free simulations in Section 3.

- Player Activity: The player activities described in Section 2 are classified into: planning, execution, or both.

- Subject/System Interface: Clearly, the requirements vary over a wide range along this dimension, depending on both the independent and dependent variable.

- Subject/Subject Interface: This dimension, applicable only to multi-subject experiments, varies significantly from experiment to experiment.

- Independent Variables

- Dependent Variables

Arraying the stated requirements along these eight dimensions gave rise to 26 different classes of experiments. These are listed in Appendix B and designated with a five/element designator. The first four elements are principally descriptors that specify the first four dimensions listed above. The last element refers to unique combinations of the last four elements and is in itself adequate identification of the class. These 26 sets of experiment classes became the building blocks of program elements for the rest of the program development since the objective of the exercise is to provide the capability to perform these classes of experiments over a five year period.

5.3 N^2 CHART DEVELOPMENT

Definition of the constraints on this problem requires, first, definition of the hardware and software modules required to implement each class of experiment. A technique developed by SAI personnel for organizing the architecture of complex systems, and know as the N^2 Chart is very useful for this purpose. Figure 5-1 illustrates such an N^2 chart for one of the more complex lab configurations. The principal functions to be performed by the man-machine system that comprises the lab in this case are shown as solid squares

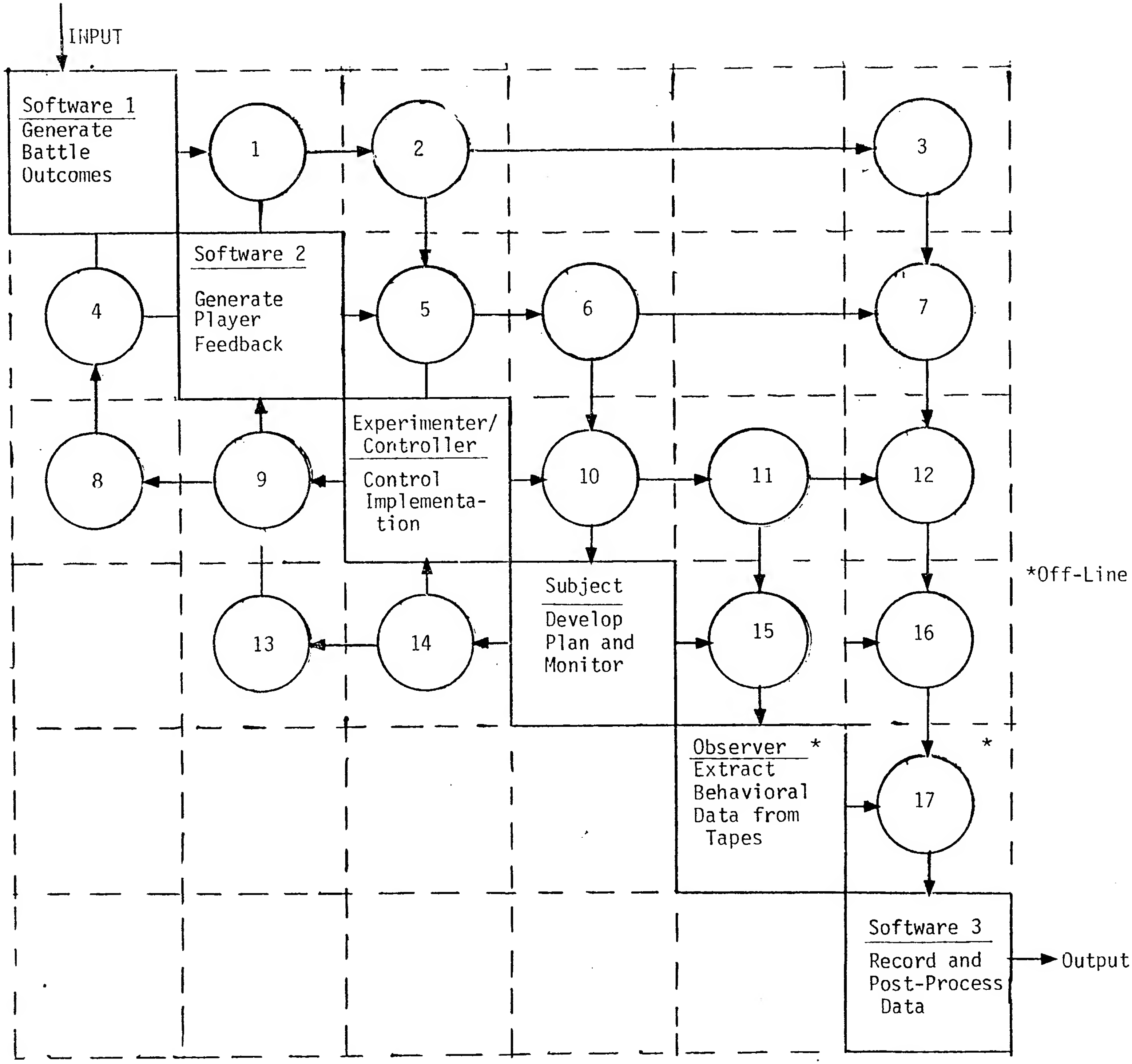


FIGURE 5-1 N^2 CHART FOR EXPERIMENT CLASS NUMBER R2IB11, R2IB12, P2IB13, P3IB14, P3IB1

along the diagonal of a 6 X 6 matrix. In this case $N^2 = 36$. A general description of each function appears in the center of the function box and the "who" or "what" performing the function appears at the top of the box. The dotted squares comprising the remainder of the matrix represent potential interfaces between the functions. The interfaces actually required have been filled in with numbered circles. Blank dotted squares indicate that no interface is required. The function in the same row as the numbered interface originates the interface data and the function in the same column receives it. The arrows indicate the direction of data flow. Table 5-1 defines in greater detail: each function, the input to the system, each interface, and the system output.

Such N^2 charts and the accompanying descriptions of functions, inputs, interfaces, and outputs were developed for each of the experiment classes defined in Appendix B and are appended at Appendix C.

TABLE 5-1, FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R21B11

FUNCTION DESCRIPTION

SOFTWARE 1:
- Generates battle outcomes
- Maintains true data base

SOFTWARE 2:
- Generates subject data degraded in accordance with controls imposed by experimenter (ITF9)
- Generates all subject displays

EXPERIMENTER/CONTROLLER:
- Sets control levels for Software 2
- Enters plan elements and orders received from subject (ITF14) and those generated by OPFOR
- Generates error messages to subject (ITF10) for illegal plans or orders
- Introduces prompts
- Communicates with subject via voice and hard copy

NOTE: If more than one terminal is installed for subject use, experimenter can impose controls listed at ITF9 either individually or collectively

SUBJECT:
- Generates plan elements and orders
- Request information (menus and displays)
- Request elementary decision aids
- Generates displays
- Generates responses
- Communicates with controller via voice and hard copy
- Communicates with other subjects via voice and hard copy

OBSERVER:
- Reviews audio and video tapes and hard copy to extract internal subject data exchanges, data exchanges with controller, decision style and behavioral data. This function is performed off-line after experiment is over.

SOFTWARE 3:
- Records ground truth history and all interface data (on line)
- Post-processes interface data to produce outputs (on line)
- Performs off-line statistical analyses of observer records of internal and external data exchanges, decision style and behavioral data.

TABLE 5-1, FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R2IB11 (CONT'D)

INPUT:

- Forces, situation, and mission data needed to initiate planning and execution
- Displays and menus
- Prompts to elicit following from subjects
  - level of perception
  - assumptions made
  - preferences responses
  - data/relationship assimilation
  - demographic, biographic, and decision style data
- Flags and associated responses for key events

INTERFACES:

1. Ground truth data needed to generate displays requested by subject
2. Ground truth data requested by experimenter/controller and acknowledgement of orders entered at ITF8
3. Record of ground truth history and all transactions at ITF1 and ITF2
4. Request for gound truth needed to generate displays requested by subject ITF13
5. Any display requestable by subject at ITF13; all prompts requested at ITF9 and responses thereto.
6. Displays and elementary decision aids requested or generated by subject (ITF13; all prompts requested at ITF9 and responses thereto
7. Record of all transactions at ITF4, ITF5 and ITF6
8. Experimenter:
   - Requests (via format) for ground truth displays

TABLE 5-1, FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R21B11 (CONT'D)

- Entry of plan elements and orders generated by subject (ITF14) into battle outcome generator

- Selection of ratio of game time to real time

9. Experimenter selection of:

   - Minimum interval between subject requests for situation update

   - Number of data classes included in single update

   - Mode of presentation to subject (visual display or software generated audio) for selected data classes

   - Inaccuracies introduced into ground truth in subject displays

   - Deliberate untruth substituted for ground truth in subject display

   - Distribution of delay times between "as of" time of ground truth and time presented to subject

   - Initial situation used for planning and execution

   - Display data organization (level of detail, format, grouping)

   - Display symbology

   - Prompts to be displayed to subject

   NOTE: Experimenter can interrupt and override display selected by subject; such interruption stops the game clock in Software 1 until experimenter starts it again. Note also that experimenter exercise of controls listed above on an individual basis for multiple subject displays effectively forces selected intersubject communications into voice mode.

10. Experimenter generated:

    - Error messages to subject informing him of non-admissable plan elements or orders

TABLE 5-1, FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R21B11 (CONT'D)

- Acknowledgements of accepted plan elements and orders
- Voice and hard copy transfer of data to subject

11. Audio recording of experimenter/controller voice transmissions and hard copy sent to subject and received from his
12. Record of ITF8, ITF9, and ITF10 (except voice)
13. Subject selection of:
    - Needed Data (menus and displays)
    - Self-generated displays
    - Elementary decision aids
    - Responses to prompts
    - Assumptions made
    - Choice of inter-subject addressee (multiple terminals)
14. Voice and hard copy transfer of data requesting and acknowledging information and providing solutions to assigned tasks
15. Video and audio recording of player actions and voice transmission of data internally and externally
16. Record of ITF13 and ITF14
17. Record of data exchanges (internal and external), decision style and behavioral data for statistical analysis (off line)

OUTPUTS:

- Displays and data types selected by planning and execution
- Sequences of displays and data types selected by planning and execution

TABLE 5-1, FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R21B11 (CONT'D)

- Level of detail authorized/selected by planning and execution
- Cross-referencing by display
- Access time per display by planning and execution
- Response time per prompt
- Level of perception for each perception prompt
- Demographic, biographic, and decision type data and classification into type of each
- Preference responses to preference prompts by planning and execution
- Assumption made by planning and execution
- Data/relationship assimilation responses to prompts by planning and execution
- Response times to pre-selected critical events
- Plans and orders generated
- Combat outcomes
- Offline statistical analysis of:
  - data exchanges
  - decision style
  - behavioral data
  - communication errors
  - hardcopy solutions developed

The 26 functional N^2 charts shown in Appendix C were then merged into a single N^2 chart which took into account all functions of the 26 experiments. That chart is shown in Figure 5-2. Shown along the diagonal of this chart and inside the double boundary lines are 11 software modules; outside the double lines and along the diagonal are major components of the environmental external to the computer. As before, squares off the diagonal identify required interfaces. Table 5-2 provides a glossary of terms used. Table 5-3 provides descriptions of the 11 software modules required and Table 5-4 provides descriptions of the numbered interfaces at Figure 5-2. Table 5-5 further structures the actual data flowing between the software modules and the external major components.

The balance of Section V describes material relevant to the SAI analyses which were used to evaluate the impact of hardware and software procurement sequences on the complexity of experiments. The omitted subsections essentially demonstrate that going immediately to a facility that would conduct the most complex kinds of C^2 research would be very expensive and, furthermore, that a facility that permitted all of the experiments of the two least complex types would require about 80% of that total. The report recommends that the extensive front end loading of costs be controlled by a laboratory hardware/software development process that develops meaningful but not complete capability at lower levels than advances to similar partial capability at each succeeding higher level. This approach spreads the cost by requiring an investment of about 40% of the potential total as start up costs and adding costs at a more linear rate as more complex and broader classes of research efforts are made possible over a five year period. Cost estimates to support these conclusions are also contained in this section. It is also shown that because NTC modules can be used there is a significant cost savings.

Subsequent to the delivery of this report, ARI awarded SAI a follow-on concept evaluation contract. Using contractor owned equipment and existing software from NTC and other sources, SAI created an interim version of the full laboratory described here. In part based on that evaluation and in part based on PPBS factors, ARI has chosen not to adopt the incremental approach to hardware acquisition recommended by SAI. Therefore, the cost analyses in the remainder of this section are no longer relevant.

External Environment	1									2	3			
4	Pre-Processing	5		6	7	8								
		Battle Simulation	9				10							
			Simulation Output Control		11	12	13							
				Experiment Control	14	15								
					Output Control							16	17	
	18	19	20	21	22	Inter-active Input	23	24	25	26		27	28	
29							Data Recording	30		31	32			
		33	34		35			Feedback Control						
36									Manual Data Collection	37	38			
										Data Analysis	39			
40											Report Preparation			
						41					42	Experimen-ter Station(s)	43	
						44						45	Subject Station(s)	46
47												48		Audio/ Visual Recording

FIGURE 5-2 FULL UP LABORATORY N^2 CHART

TABLE 5-2, GLOSSARY

Alter Simulation Data Command	A directive to modify in some way (accuracy, detail, frequency, completeness, delay) data from the Simulation data base to create the Altered Simulation data base.
Altered Simulation Data Base	The Simulation DB as modified by the Simulation Output Control function, under the experimenter's control.
Analysis Command	Directives that cause sorting, compilation, and statistical manipulation of recorded and archived data.
Analyzed Data	Data that have been manipulated by the Data Analysis function.
Command and Control Events (C^2 Events)	Real-time inputs to a battle simulation that guide the conduct and future course of the simulation, such as maneuver and fire commands.
Critical Events	Key simulation events that are flagged to cause special processing.
Data Format Commands	Directives that cause processed and archived data to be formatted as tables and graphs for incorporation with text into an experiment report.
Display Commands	A command to display maps, symbology, reports, and graphs.
Experiment Control Commands	Commands that control the flow of data to/from the subject and experimenters stations.
Experiment Report	The document that reflects the planning, conduct, and results of an experiment.
Feedback Command	A directive to replay record data in a structured fashion and with specified displays.
Graphs	Graphical representation of numeric data, such as histograms, bar and line charts, and pie charts.
Maps	2-D and 3-D representations of terrain, including shaded relief, cross-country mobility vegetation, elevation banding, and combinations thereof.
Menu Command File	A sequence of menus to be used during an experiment, either forced, as requested by the subject, or regulated by the experimenter, as determined through use of the experiment control function.

Menu Description	The definition of a menu, including menu name, type, contents, legal input values, related data entities. The description is created or modified by the preprocessing function, and used by the interactive input function.
Menu Display Command	A directive to display a menu at a console based on Experimental Control function processing of menu command files.
Menu Responses	All responses and commands input by a subject or experimenter through keyboard, graph tablet, or voice recognition.
Menus	The means by which the subject and experimenter interact with the system. Included are directives, questions with responses, option choices, and linked chains of other menus. The media could be graphics console, graphics tablet, alphanumeric terminal or keyboard.
Observation Data	Data manually entered into a file based on observations of subject(s) during an experiment, or observed from video/audio tapes.
Pre-Processing Command	A directive to input data and control pre-processing functions.
Processed Data	Simulation data, observation data, and interactive actions of subjects and experimenters that nave been analyzed.
Reports	Alphanumeric data that reflect key events and status information of simulated battlefield situations.
Scenario Data Base	Location and status of entities on a battlefield at a given time, and all parameters needed by the simulation model to conduct battlefield simulation.
Simulation Control Command	A directive to position, replay, freeze, or change speed of the Battle Simulation function.
Simulation Data Base	Location, activity, and status of all simulated units, as well as all battlefield events as they occur.
Symbology	Graphic symbols that represent physical entities and planning data. Symbology represents certain situations overlayed on maps.

TABLE 5-2, GLOSSARY (CONTD.)

Text	Prose sections of experiment reports, created through word processing capability.
Voice	Data presented to subjects through voice synthesis.

TABLE 5-3, SOFTWARE MODULE DESCRIPTIONS

Software Module	Functions	
Pre-processing	Maps Menu Descriptions Menu Command Files Symbology	Terrain Files Scenario Data Bases Critical Events Audio Words (Voice)
Battle Simulation	Math Models Simulation Control: Role of Play Replay Position/freeze	
Simulation Output Control	Accuracy Level of Detail Frequency of reports Delayed presentation Data completeness	
Experiment Control	Edit-Override Menu Command Files Mode of Operation: Force data Free request Review subjects displays Display duration Decision time span	
Output Control	Maps Symbology Reports Graphs	Voice Hard copy Analysis tools
Interactive Input	Menu Descriptions + data from Simulation DB or Simulation Output DB, as controlled by Experiment Control	
Data Recording	Simulation Data Base Simulation Output Control DB Interactive Actions	
Feedback Control	Create Menu Command Files and Simulation Control Commands	
Manual Data Collection	Data collection of observations: audio, video, real-time	
Data Analysis	Statistical data manipulation Reports, Graphs	
Report Preparation	Word Processing Data File formatting	

TABLE 5-4, INTERFACE DESCRIPTIONS

Output from	Input to	Interface Number	Description
External Environmental	Pre-processing	1	Scenarios, terrain, menu descriptions, menu command files, symbology, scenario data bases
	Data Analysis	2	Recorded data (simulation, altered sim., interactive inputs, observations) from previous experiments
	Report Preparation	3	Experiment Reports (previous experiments)
Pre-processing	External Environ.	4	New/modified data files
	Battle Simulation	5	Scenario DB, terrain DB, critical event flags
	Experiment Control	6	Menu command files
	Output Control	7	Map, symbology, reports, graphs, voice
	Interactive Input	8	Menu descriptions
Battle Simulation	Simulation Output Control	9	Simulation Data Base
	Data Recording	10	Simulation Data Base
Simulation Output Control	Output Control	11	Altered Simulation DB
	Interactive Input	12	Altered Simulation DB
	Data Recording	13	Altered Simulation DB
Experiment Control	Output Control	14	Display Commands
	Interactive Input	15	Menu display command
Output Control	Experimenter	16	Maps, symbology, reports, graphs, voice
	Subject	17	Maps, symbology, reports, graphs, voice

TABLE 5-4, INTERFACE DESCRIPTIONS (CONTD.)

Output from	Input In	Interface Number	Description
Interactive Input	Pre-processing	18	Pre-processing commands
	Battle Simulation	19	Command and Control Events, Simulation Control Commands
	Simulation Output Control	20	Alter simulation output commands
	Experiment Control	21	Experiment control commands
	Output Control	22	Display commands
	Data Recording	23	All menu responses
	Feedback Control	24	Feedback commands
	Manual Data Collection	25	Video/audio/real-time observation data
	Data Analysis	26	Analysis Commands
	Experimenter	27	Menus
	Subject	28	Menus
Data Recording	External Environ.	29	Recorded Simulation DB, Altered Sim. DB, Menu Responses, Feedback Commands
	Feedback Control	30	Recorded Simulation DB, Altered Sim. DB
	Data Analysis	31	Simulation DB, Altered Sim. DB, Menu Responses, Feedback Commands
	Report Prep.	32	Simulation DB, Altered Sim. DB, Menu Responses, Feedback Commands
Feedback Control	Battle Simulation	33	Simulation Control Commands
	Simulation Output Control	34	Alter simulation Output Commands
	Output Control	35	Display Commands

TABLE 5-4, INTERFACE DESCRIPTIONS (CONTD.)

Output from	Input In	Interface Number	Description
Manual Data Collection	External Environ.	36	Recorded video/audio/real-time observation data
	Data Analysis	37	Recorded observation data
	Report Prep.	38	Recorded observation data
Data Analysis	Report Prep.	39	Processed data
Report Prep.	External Environ.	40	Experiment report
Experimenter	Interactive Input	41	Menu responses: Simulation Control Commands, C^2 Events. Experiment Control Commands, Alter Simulation Output Commands, Display Commands, Feedback Commands, Observation Data, Analysis Commands, Pre-processing Commands
	Report Preparation	42	Text, Data Format Commands
Subject	Interactive Input	44	Menu Responses: C^2 Events, Display Commands

TABLE 5-5, INTERFACE DATA

	Data Name	Sent From	Sent To
1.	Alter Simulation Output Command	Interactive Input	Simulation Output Control
		Experimenter	Interactive Input
		Feedback Control	Simulation Output Control
2.	Altered Simulation	Sim. Output Control	Output Control
		Sim. Output Control	Interactive Input
		Sim. Output Control	Data Recording
		Data Recording	External Environ.
		Data Recording	Feedback Control
		Data Recording	Data Analysis
		Data Recording	Report Preparation
3.	Analysis Command	Interactive Input	Data Analysis
		Experimenter	Interactive Input
4.	Command and Control Event	Experimenter	Interactive Input
		Subject	Interactive Input
		Interactive Input	Battle Simulation
5.	Critical Event	Pre-processing	Battle Simulation
6.	Data Format Command	Experimenter	Report Preparation
7.	Display Command	Experimenter	Interactive Input
		Subject	Interactive Input
		Interactive input	Output Control
		Experiment Control	Output Control
		Feedback Control	Output Control
8.	Experiment Control Commands	Experimenter	Interactive Input
		Interactive Input	Experiment Control
9.	Experiment Report	Report Preparation	External Environment
10.	Feedback Command	Experimenter	Interactive Input
		Interactive Input	Feedback Control
		Data Recording	External Environ.
		Data Recording	Data Analysis
		Data Recording	Report Preparation
11.	Graphs	Pre-processing	Output Control
		Output Control	Experimenter
		Output Control	Subject

TABLE 5-5 , INTERFACE DATA (CONTD.)

	Data Name	Sent From	Sent To
12.	Maps	Pre-processing Output Control Output Control	Output Control Experimenter Subject
13.	Menu Command File	Pre-processing External Invironment	Experiment Control Pre-processing
14.	Menu Description	External Invironment Pre-processing	Pre-processing Interactive Input
15.	Menu Display Command	Experiment Control	Interactive Input
16.	Menu Responses	Experimenter Subject Interactive Input	Interactive Input Interactive Input Data Recording
		Data Recording Data Recording Data Recording	External Environ. Data Analysis Report Presentation
17.	Menus	Interactive Input Interactive Input	Experimenter Subject
18.	Observation Data	External Invironment Interactive Input Manual Data Collection Manual Data Collection Manual Data Collection Experimenter	Data Analysis Manual Data Collection External Environ. Data Analysis Report Preparation Interactive Input
19.	Pre-processing Command	Interactive Input Experimenter	Pre-processing Interactive Input
20.	Processed Data	Data Analysis	Report Preparation
21.	Reports	Pre-processing Output Control Output Control	Output Control Experimenter Subject
22.	Scenario Data Base	External Environment Pre-processing	Pre-processing Battle Simulation
23.	Simulation Control Command	Interactive Input Feedback Control Experimenter	Battle Simulation Battle Simulation Interactive Input

TABLE 5-5, INTERFACE DATA (CONTD.)

	Data Name	Sent From	Sent To
24.	Simulation Data Base	Battle Simulation	Simulation Output Control
		Battle Simulation	Data Recording
		Data Recording	External Environment
		Data Recording	Feedback Control
		Data Recording	Data Analysis
		Data Recording	Report Preparation
25.	Symbology	External Environment	Pre-processing
		Pre-processing	Output Control
		Output Control	Experimenter
		Output Control	Subject
26.	Text	Experimenter	Report Preparation
27.	Voice	Pre-processing	Output Control
		Output Control	Experimenter
		Output Control	Subject

Section 6

SUMMARY OF SECTION 6 (PLAN FOR IMPLEMENTING THE C^2 SIMULATION LABORATORY)

This section briefly described a development alternative for incremental acquisition of hardware and software over a five year period. ARI elected to adopt a different acquisition approach as this section's original content is no longer of interest.

APPENDIX A

(Listed the References which Supported the Material

in Section 2 of the Report)

7 January 1983

SUMMARY OF EXPERIMENT CLASSES TO BE CONDUCTED IN THE ARI C^2 LAB AS DERIVED FROM THE PLANNING GUIDANCE

The experiments described in the planning guidance received to date have been arrayed according to the following eight dimensions:

- Type Research: C^2, Training, or Controller
- Category: Single Subject, Multiple/Team, or Automated Aids
- Data Base: Static, Moving, or Interactive
- Player Activity: Planning, Execution, or Both
- Subject/System Interface
- Subject/Subject Interface
- Independent Variables
- Dependent Variables

The following terms are used in the sense of the definitions stated below:

- PLAYER - Decision maker in simulated tactical C^2 system.
- CONTROLLER - Human interface between player and simulation.
- EXPERIMENTER - Scientist directing the experiment.
- SUBJECT - Person whose responses to variables being manipulated by the experimenter are being observed and measured. In this context the subject can be either the player or the controller.
- STATIC DATA BASE - Description of a tactical situation at a specified instant in time, as it might be perceived by one opponent (environment, friendly, and enemy). This information could include not only current values (e.g., locations, strengths, logistic levels) but also historical data, rates of change, or anticipated future levels, as appropriate. Could be generated from a time slice of the computer log tape of a combat simulation.
- MOVING DATA BASE - A continuing description of an emerging tactical situation but with which the recipient cannot interact. Most easily generated from the log tape of a completed combat simulation.
- INTERACTIVE DATA BASE - A continuing description of an emerging tactical situation which does reflect actions taken by the recipient. In general, this requires an operating combat outcome generator.

EXPERIMENT CLASS NUMBER R1SP1
(Individual Differences)

R - C^2 Research
1 - Single Subject
S - Static Data Base
P - Player Activity Planning
1 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with unrestricted access	• None	• Subjects • Situation displayed (decision type)	• Type data selected • Selected sequence • Level of detail • Cross-referencing • Access and response times • Level of perception • Solution developed

EXPERIMENT CLASS NUMBER R1SP2
(Varying Information)

R - C^2 Research
1 - Single Subject
S - Static Data Base
P - Player Activity Planning
2 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with restricted access	• None	• Level of detail (completeness) • Accuracy of information • Access time • Solution time allowed • Situation displayed (decision type)	• Response times • Level of perception • Solutions developed • Individual Preference • Type data selected • Selection sequence • Cross referencing

EXPERIMENT CLASS NUMBER R1SP3
(Selective Masking)

R - C^2 Research
1 - Single Subject
S - Static Data Base
P - Player Activity Planning
3 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with restricted access	• None	• Selective masking (completeness) • Situation displayed (decision type)	• Response times • Level of perception • Assumptions made • Solutions developed

EXPERIMENT CLASS NUMBER R1SP4
(Information Organization)

R - C^2 Research
1 - Single Subject
S - Static Data Base
P - Player Activity Planning
4 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with restricted access	• None	• Data organization: - Format - Grouping - Level of detail • Presentation sequence	• Individual preference • Data/relationship assimilation • Response times • Solutions developed

EXPERIMENT CLASS NUMBER R1MP5
(Information and Subject Characteristics)

R - C^2 Research
1 - Single Subject
M - Moving Data Base
P - Subject Activity Planning
5 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display Construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S request for change in future event coverage • Hard copy	• None	• Subjects • Level of detail (completeness) • Accuracy of information • Access time • Solution time allowed • Selective masking (completeness) • Data organization: - Format - Grouping - Level of detail • Presentation sequence • Situation displayed (decision type)	• Type data selected • Selection sequence • Level of detail • Cross-referencing • Access and response time • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Solutions developed

EXPERIMENT CLASS NUMBER R1ME6
(Information and Subject Characteristics)

R - C^2 Research
1 - Single Subject
M - Moving Data Base
E - Player Activity Execution
6 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S request for change in future event coverage • Hard copy	• None	• Subjects • Level of detail (completeness) • Accuracy of Information • Access time • Solution time allowed • Selective masking (completeness) • Data organization: - Format - Grouping - Level of detail • Presentation sequence • Situation displayed (decision type)	• Type data selected • Selection sequence • Level of detail • Cross-referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed

EXPERIMENT CLASS NUMBER R1IB7
(Cognitive Processes)

R - C^2 Research
1 - Single Subject
I - Interactive Data Base
B - Player Activity both Planning and Execution
7 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto	• None	• Frequency of update • Amount information per update • Sensory modalities • Accuracy of information • Validity of information • Subjects • Time pressure (information delay and model speed) • Decision types (scenario) • Information organization and presentation mode • Symbology	• Type data selected • Selection sequence • Level of detail • Cross-referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Combat outcomes

EXPERIMENT CLASS NUMBER R2MB8
(Information Characteristics)

R - C^2 Research
2 - Multiple/Team
M - Moving Data Base
B - Player Activity both Planning and Execution
8 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Electric voice (manual) • Audio and video recording • Hard copy	• Face to face • Audio and video recording	• Level of detail (completeness) • Accuracy of information • Access time. • Solution time allowed • Selective masking (completeness) • Data organization: - Format - Grouping - Level of detail • Presentation sequence • Situation displayed (decision type) • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross-referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers

EXPERIMENT CLASS NUMBER R2MB9
(Information Characteristics)

R - C^2 Research
2 - Multiple/Team
M - Moving Scenario
B - Player Activity both Planning and Execution
9 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S request for change in future event coverage • Electric voice (normal) • Audio and video recording • Hard copy	• Face to face • Audio and video recording or • Subjects separated • Electric voice • Automated terminal with: - Controlled display choice - Subject display construction - Elementary decision aiding • Audio and video recording	• Level of detail (completeness) • Accuracy of information • Access time • Solution time allowed • Selective masking (completeness) • Data organization: - Format - Grouping - Level of detail • Presentation sequence • Situation displayed (decision type) • Subject interaction modes • Division of labor alternative • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perceptions for selected events • Solutions developed • Communication errors • Internal data transfers

EXPERIMENT CLASS NUMBER R2MB10
(Information Characteristics)

R - C^2 Research
2 - Multiple/Team
M - Moving Scenario
B - Player Activity both Planning and Execution
10 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S request for change in future event coverage • Electric voice (manual) • Audio and video recording • Hard copy	• Face to face • Audio and video recording	• Level of detail (completeness) • Accuracy of information • Access time • Solution time allowed • Selecting masking (completeness) • Data organization - Format - Grouping - Level of detail • Presentation sequence • Situation displayed (decision type) • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Data/relationship assimilation • Time of perceptions for selected events • Solutions developed • Communication errors • Internal data transfers

EXPERIMENT CLASS NUMBER R2IB11
(Cognitive Processes)

R - C^2 Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
11 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy	• Face to face • Audio and video recording	• Frequency of update • Amount information per update • Sensory modalities • Accuracy of information • Validity of information • Subjects • Time pressure (information delay and model speed) • Information organization • Presentation mode • Symbology • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER R2IB12
(Cognitive Processes)

R - C^2 Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
12 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy	• Subjects separated • Electric voice • Automated terminal with: - Controlled display choice - Subject display construction - elementary decision aiding • Audio and video recording or • Face to face • Audio and video recording	• Subject interaction modes • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups • Level of detail (completeness) • Accuracy of information • Access time • Solution time allowed • Selective masking (completeness) • Data organization - Format - Grouping - Level of detail • Presentation sequence • Situation displayed (decision type)	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER R2IB13
(Cognitive Processes)

R - C^2 Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
13 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can responde to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy	• Face to face • Audio and video recording	• Subject interaction modes • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER R3IB14
(Cognitive Processes)

R - C^2 Research
3 - Automated Aids
I - Interactive Data Base
B - Player Activity both Planning and Execution
14 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Audio and video recording • Hard copy • Advanced decision aiding	• Face to face • Audio and video recording	• Subject interaction modes • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER R3IB15
(Cognitive Processes)

R - C^2 Research
3 - Automated Aids
I - Interactive Data Base
B - Player Activity both Planning and Execution
15 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Audio and video recording • Hard copy • Advanced decision aiding	• Subjects separated • Electric voice • Automated terminal with: - Controlled display choice - Subject display construction - Elementary decision aiding • Audio and video recording	• Subject interaction mode • Division of labor alternatives • Group decision style • Alternative procedures • Ad hoc vs non-ad hoc groups	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER T2IB16
(Simulation Fidelity)

T - Training Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
16 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy	• Face to face • Audio and video recording	• Information timeliness • Information completeness • Information accuracy • Model resolution • Time ratio • Variance of stochastic processes • Event class coverage	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER T1IB17
(Diagnostics/Feedback)

T - Training Research
1 - Single Subject
I - Interactive Data Base
B - Player Activity both Planning and Execution
17 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Diagnostics/feedback	• None	• Alternative diagnostic/ feedback packages	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Combat outcomes

EXPERIMENT CLASS NUMBER T2IB18
(Diagnostics/Feedback)

T - Training Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
18 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Audio and video recording • Diagnostics/feedback	• Face to face • Audio and video recording	• Alternative diagnostics/ feedback packages	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data trrnsfers • Combat outcomes

EXPERIMENT CLASS NUMBER T2IB19
(Diagnostics/Feedback)

T - Training Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
19 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy • Diagnostics/feedback	• Face to face • Audio and video recording	• Alternative diagnostic/ feedback packages	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER T2IB20
(Diagnostics/Feedback)

T - Training Research
2 - Multiple/Team
I - Interactive Data Base
B - Player Activity both Planning and Execution
20 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automatic terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy	• Subjects separated • Electric voice • Automated terminal with: - Controlled display choice - Subject display construction - Elementary decision aiding • Audio and video recording	• Alternative diagnostics/ feedback packages	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

EXPERIMENT CLASS NUMBER T1IB21
(Advanced Technology)

T - C^2 Training Research
1 - Single Subject
I - Interactive Data Base
B - Player Activity both Planning and Execution
21 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) - Can response to S plans and mods thereto • Advanced technology (e.g., micro computers, video disks, voice interactive devices, AI programming, adaptive programming)	• None	• Alternative technologies	• Response times • Level of perception • Assumptions made • Data/relationship assimilation • Individual preference • Solutions developed • Combat outcomes

EXPERIMENT CLASS NUMBER C1MB22
(After Action Summary)

C - Controller Research
1 - Single Subject
M - Moving Data Base
B - Player Activity both Planning and Execution
22 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction • Audio and video monitor	• None	• Alternative after-action techniques and formats	• Use with T1IB17 or T2IB18 through 20 for evaluation

EXPERIMENT CLASS NUMBER C1MB23
(Controller Interface and Tasks)

C - Controller Research
1 - Single Subject
M - Moving Data Base
B - Player Activity both Planning and Execution
23 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction • Controlled alternative interaction logic and graphics (see independent variables)	• None	• Nomographs for admin/log • Alternative display logic and graphics • Alternative data entry: - Speech - Touch panel - Mouse - Track ball - Light pen • Speech synthesis • Shift of controller tasks to computer	• Response times • Level of perception • Assumptions made • Data/relationship assimilation • Individual preference • Solutions developed

EXPERIMENT CLASS NUMBER C2IB24
(Controller Interface and Tasks)

C - Controller Research
2 - Multi-Subject/Tean
I - Interactive Data Base
B - Player Activity both Planning and Execution
24 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction • Controlled alternative interaction logic and graphics (see independent variables) • Audio and video recording	• Face to face • Automated terminal with: - Controlled display choice - Subject display construction - Elementary decision aiding • Audio and video recording	• Nomographs for admin/log • Alternative display logic and graphics • Alternative data entry: - Speech - Touch panel - Mouse - Track ball - Light pen • Speech synthesis • Shift of controller tasks to computer • Audio and video recording	• Response times • Level of preception • Assumptions made • Data/relationship assimilation • Individual preference • Solutions developed • Communication errors, both intercontroller and intersystem • Combat outcomes

EXPERIMENT CLASS NUMBER T1IB25
(Simulation Fidelity)

T - Training Research
1 - Single Subject
I - Interactive Data Base
B - Player Activity both Planning and Execution
25 - See Table Below

SUBJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding (e.g., radar and weapon coverage) • Can respond to S plan and mods thereto • Electric voice (manual) • Audio and video recording • Hard copy • Can respond to S interaction with simulated other staff members	• Face to face • Audio and video recording	• Information timeliness • Information completeness • Information accuracy • Model resolution • Time ratio • Variance of stochastic processes • Event class coverage	• Type data selected • Selection sequence • Level of detail • Cross referencing • Access and response times • Level of perception • Assumptions made • Individual preference • Data/relationship assimilation • Time of perception for selected events • Solutions developed • Communication errors • Internal data transfers • Combat outcomes

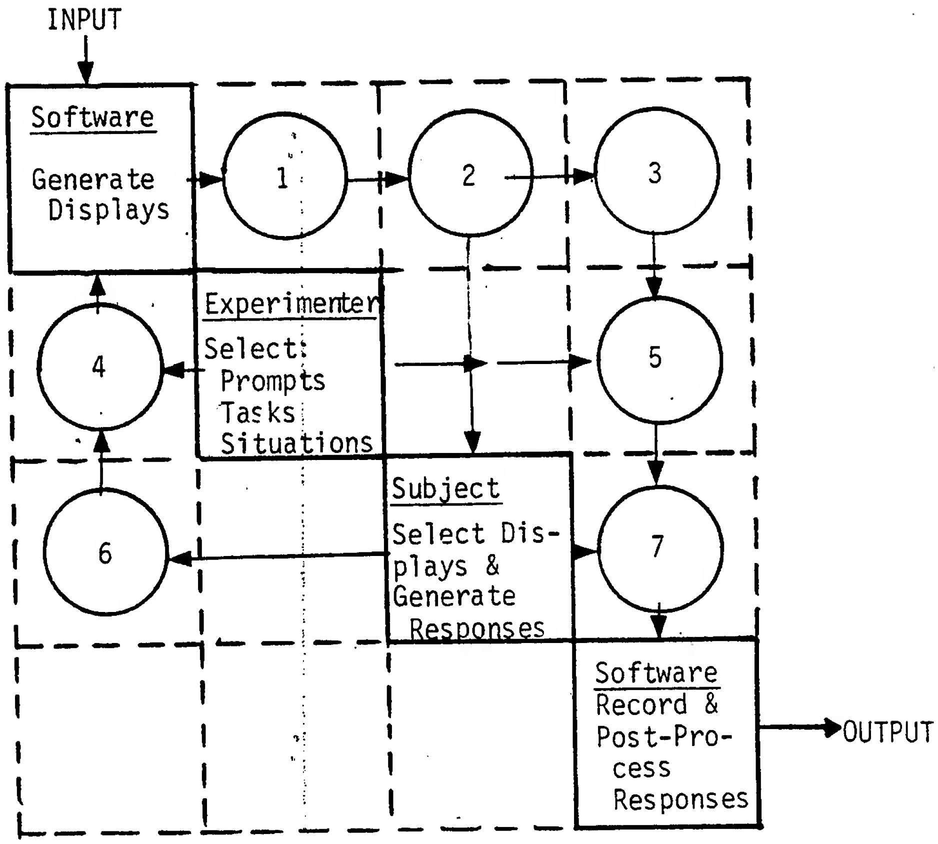
EXPERIMENT CLASS NUMBER C3MA26
(Cognitive Processes)

C - C^2 REsearch
3 - Automated Aids
M - Moving Data Base
A - Player Activity both Planning and Execution
26 - See Table Below

SYSJECT/SYSTEM INTERFACE	SUBJECT/SUBJECT INTERFACE	INDEPENDENT VARIABLES	DEPENDENT VARIABLES
• Automated terminal with: - Subject display choice - Subject display construction - Elementary decision aiding	• None	• Subjects	• Type data selected
• Can respond to S request for change in future event coverage		• Level of detail (completeness)	• Selection sequence
• Can respond to controlled list of S requested if statements in S constructed format		• Accuracy of information	• Level of detail
• Advanced decision aiding		• Access time	• Cross referencing
		• Solution time allowed	• Access and response time
		• Selective masking (completeness)	• Level of perception
		• Data organization - Format - Grouping - Level of detail	• Assumptions made
		• Presentation mode	• Individual preference
		• Presentation sequence	• Data/relationship assimilation
		• Situation displayed (decision type)	• Time of perception for selected events
			• Solutions developed

APPENDIX C

N^2 CHARTS AND DESCRIPTIONS



N^2 CHART FOR EXPERIMENT CLASS NR R1SP1

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1SP1

FUNCTION DESCRIPTIONS

SOFTWARE - Store:

Prompts to elicit demographic, biographic, and decision style data

Prompts to elicit level of perception

Display menu and formats

Decision (planning) tasks and associated situations where a situation = a time slice of a combat model generated data base plus historical data, future data, or rates of change for pre-selected attributes.

- Generate displays selected by experimenter (Interface 4) or subject (Interface 6).

EXPERIMENTER - Selects prompts, tasks, and situations
Turns subject display on or off

SUBJECT - Generates responses to prompts and tasks
Selects displays from menu

SOFTWARE - Store prompts, tasks, situations, displays, selected and subject responses

Post-process subject selections and responses to produce outputs.

INPUT

- Prompts to elicit demographic, biographic, and decision style data from subject
- Prompts to elicit level of perception from subject
- Decision tasks (planning) to be performed by subject

INPUT (Cont'd)

- Situations providing data needed to perform assigned tasks
- Display formats
- Display menu

INTERFACES (ITF)

1 - All displays generated as a result of prompts, tasks, and situations selected by experimenter (ITF4); display menu and display selected and responses entered by subject (ITF6)

2 - Identical to ITF1 when experimenter activates subject display

3 - Record of ITF1

4 - Experimenter selection of:

    - Prompts to be displayed
    - Tasks to be presented
    - Situation to be accessed for reference
    - Subject display "on" or "off"

5 - Record of selections made at ITF4

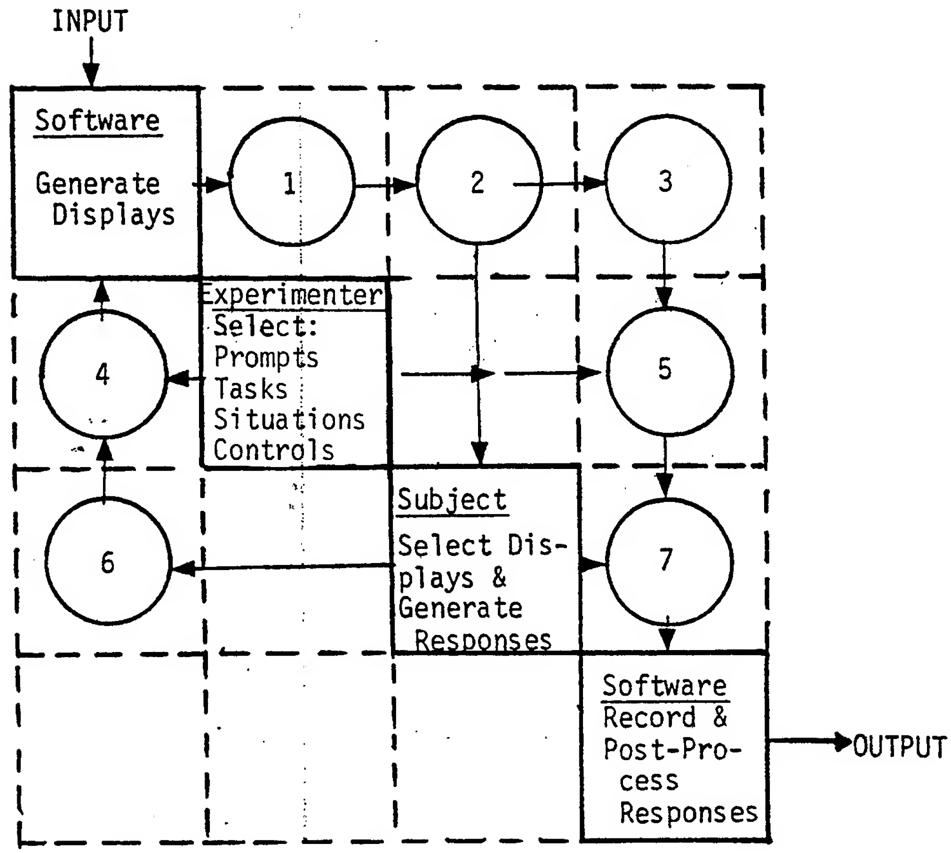
6 - Subject selection from display and data class menu and subject responses to prompts and tasks.

7 - Record of subject selections and responses at ITF6.

NOTE: Experimenter can interrupt and override display selected by subject.

OUTPUTS

- Displays and type data selected per task
- Sequence of display and data type selection per task
- Level of detail by data class selected by task
- Cross-referencing, i.e., data classes combined into a single display per task
- Access time each display per task
- Response times per prompt and per task and sub-task
- Level of perception for each perception prompt
- Demographic, biographic, and decision style data and classification into type of each
- Solution to each assigned task



N^2 CHART FOR EXPERIMENT CLASS NR R1SP2

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1SP2

FUNCTION DESCRIPTION

SOFTWARE - Store:

Prompts to elecit demographic, biographic, and decision decision style data

Prompts to elicit level of perception

Prompts to elicit subject preference for:

- level of detail
- level of accuracy
- access time
- solution time

Display menu and formats

Decision (planning) tasks and associated situations

Generate displays selected by experimenter (ITF4) or subject (ITF6)

EXPERIMENTER - Selects prompts, tasks, and situations

Sets:

- level of detail of data displayed in response to subject request (ITF6)
- level of inaccuracy introduced by software into data requested by subject (ITF6)

Controls:

- access time of subject to displays he requests (ITF6)
- time available to subject for generating responses to tasks

FUNCTIONS AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1SP2, Contd.

SUBJECT - Generates responses to prompts and tasks
Selects displays from menu

SOFTWARE - Stores prompts, tasks, situations, displays selected; controls exercised; and subject responses

Post-process subject selections and responses to produce outputs

INPUT

- Prompts to elicit demographic, biographic, and decision style data from subject
- Prompts to elicit level of perception from subject
- Decision tasks (planning) to be performed by subject
- Situations providing data needed to perform assigned tasks
- Display formats
- Display menu
- Prompts to elicit subject preference for: level of detail, level of accuracy, access time, and solution time

INTERFACES (ITF)

1 - All displays generated as a result of prompts, tasks, situations, and controls selected by experimenter (ITF4); menus and displays selected and responses entered by subject (ITF6)

2 - Experimenter selected prompts, tasks, and situations; subject selected menus and displays but subject to controls imposed by experimenter (ITF4); subject generated responses

3 - Record of ITF1 and ITF2

4 - Experimenter selection of:

- Prompts to be displayed

- Tasks to be presented
- Situation to be accessed for reference
- Level of detail of presentations
- Level of accuracy of presentation
- Display access time by subject
- Solution time allowed subject

NOTE: Experimenter can interrupt and override display selected by subject.

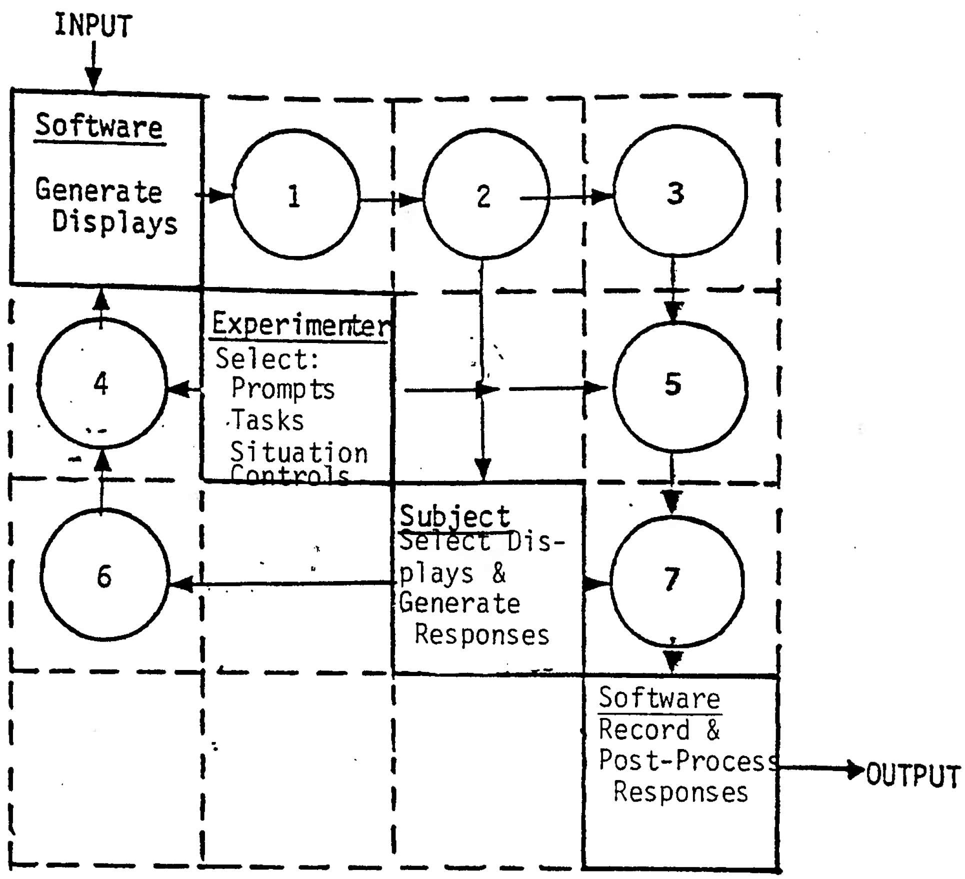
5 - Record of selections made at ITF4

6 - Subject selection from display and data class menu and subject responses to prompts and tasks.

7 - Record of subject selections and responses at ITF6.

OUTPUTS

- Displays and data types selected per task
- Sequence of display and data type selection per task
- Level of detail authorized for each data class by task
- Cross-referencing, i.e., data classes combined into single display per task
- Access time authorized for each display per task
- Response times per prompt
- Response times authorized per task and sub-task
- Level of perception for each perception prompt
- Demographic, biographic, and decision style data and classification into type of each
- Preference responses of subject to preference prompts by task
- Solution to each assigned task



N^2 CHART FOR EXPERIMENT CLASS NR R1SP3

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1SP3

FUNCTION DESCRIPTION

SOFTWARE - Store:

Prompts to elicit demographic, biographic, and decision style data

Prompts to elicit level of perception

Display menu and formats

Decision (planning) tasks and associated situations

Provision for masking pre-selected portions of situation data base

Generate displays selected by experimenter (ITF4) or subject (ITF6)

EXPERIMENTER - Selects prompts, tasks, and situations

Selects masks to be applied to subject displays

Turns subject display on or off

SUBJECT - Generates responses to prompts and tasks

Selects displays from menus

SOFTWARE - Store prompts, tasks, situations, masking, displays selected and subject responses

Post-process subject selections and responses to porduce outputs.

INPUT

- Prompts to elicit demographic, biographic, and decision style data from subject
- Prompts to elicit level of perception from subject
- Decision tasks (planning) to be performed by subject
- Situations providing data needed to perform assigned tasks
- Display formats
- Display menu

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1SP3

INTERFACES (ITF)

1 - All Displays generated as a result of prompts, tasks, maskings, and situations selected by experimenter (ITF4); display menu and displays selected and responses and assumptions entered by subject (ITF6)

2 - Subject selected menus and displays but subject to masking imposed by experimenter (ITF4); subject generated responses and assumptions

3 - Record of ITF1 and ITF2

4 - Experimenter selection of:

- Prompts to be displayed
- Tasks to be presented
- Situations to be accessed for reference
- Masking to be applied to subject requested data
- Subject display "on" of :off"

NOTE: Experimenter can interrupt and override display selected by subject.

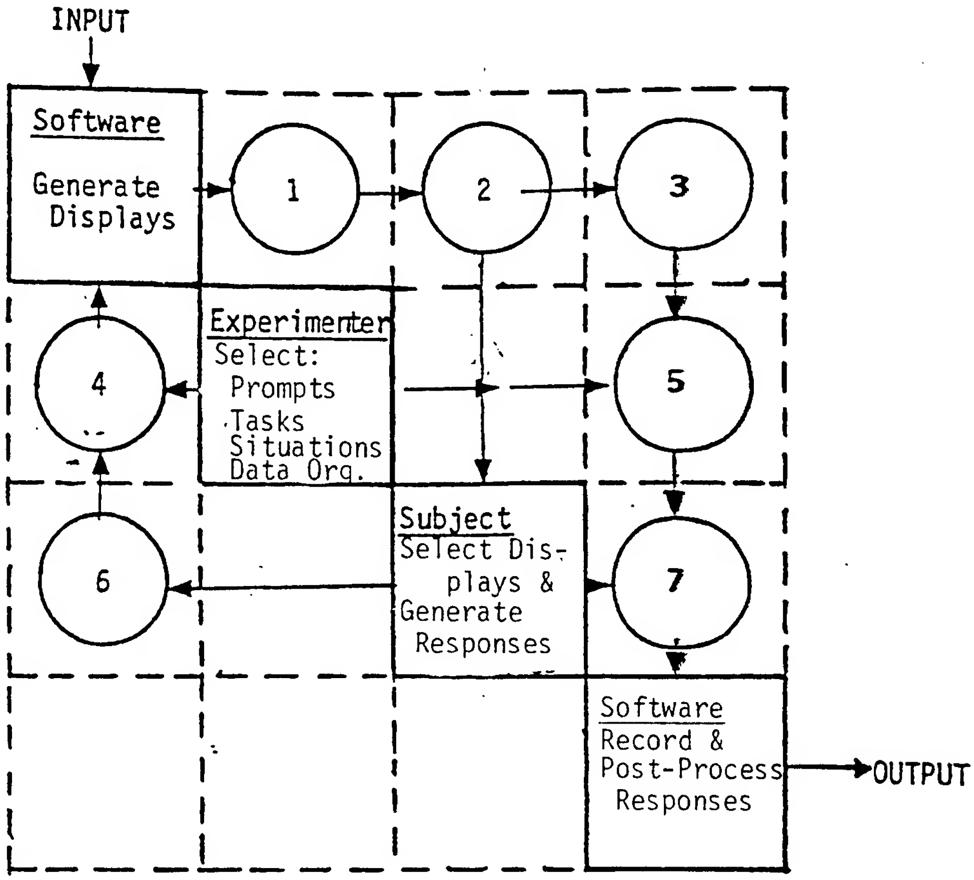
5 - Record of selections made at ITF4

6 - Subject selections from display and data class menu, subject assumptions entered to substitute for "masked" data, and subject responses to prompts and tasks.

7 - Record of subject selections and entries at IF6.

OUTPUTS

- Response times per prompt and per task and sub-task
- Level of perception for each perception prompt
- Assumptions made (data entered by subject in lieu of masked data and selected responses to perception prompts) ordered by task
- Solution to each assigned task



N^2 CHART FOR EXPERIMENT CLASS NR. R1SP4

FUNCTIONS AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1SP4

FUNCTION DESCRIPTION

SOFTWARE - Store:

Prompts to elicit demographic, biographic, and decision style data

Prompts to elicit data/relationship assimiliation

Prompts to elicit display organization and sequence preference

Display menu and formats

Decision (planning) tasks and associated situations

Provision for altering organization of displays to include: format, grouping, and level of detail, and sequence of presentation

Generate displays selected by experimenter (ITF4) or subject (ITF6)

EXPERIMENTER - Selects prompts, tasks, situations, display organization of subject displays; turns subject display "on" or "off"

SUBJECT - Generate responses to prompts and tasks

Select displays from menus

SOFTWARE - Store prompts, tasks, situations, display organization, displays selected and subject responses

Post-process subject selections and responses to produce outputs.

INPUT

- Prompts to elicit demographic, biographic, and decision style data from subject
- Prompts to elicit data/relationship assimilation
- Prompts to elicit display organization and sequence preference

- Decision tasks (planning) to be performed by subject
- Situations providing data needed to perform assigned tasks
- Display formats
- Display menu

INTERFACES (ITF)

1 - All displays generated as a result of prompts, tasks, display organization changes, and situations selected by experimenter (ITF4); display menu and displays selected and responses entered by subject (ITF6)

2 - Subject selected menus and displays, but subject to display organization and sequence specified by experimenter (ITF4); subject generated responses.

3 - Record of ITF1 and ITF2.

4 - Experimenter selection of:

- Prompts to be displayed
- Tasks to be presented
- Situations to be accessed for reference
- Display organization and sequence
- Subject display "on" or "off"

NOTE: Experimenter can interrupt and override display selected by subject.

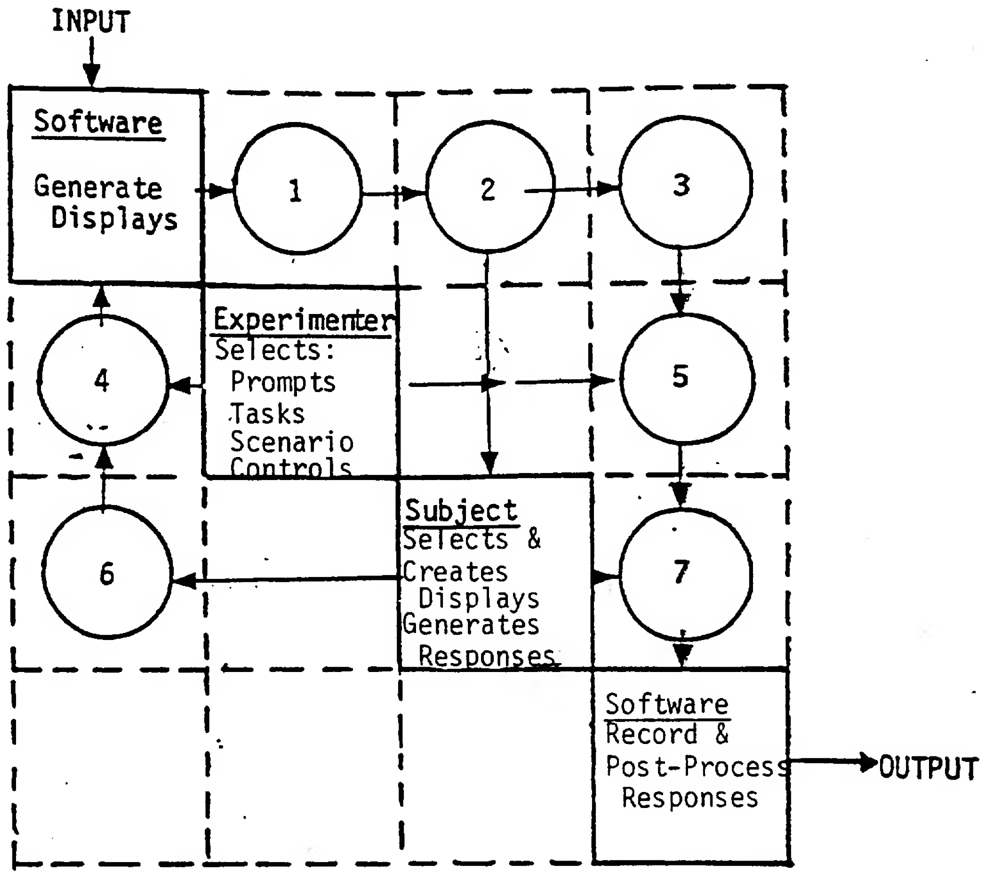
5 - Record of selections made at ITF4

6 - Subject selections from display menu and subject responses to prompts and tasks.

7 - Record of subject selections and entries at ITF6.

OUTPUTS

- Preference responses of subject to preference prompts by task
- Data/relationship assimilation responses to prompts by task
- Response times per prompt and per task and sub-task
- Solution to each assigned task



N^2 CHART FOR EXPERIMENT CLASS NRR1MP5 & R1ME6

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1MP5

FUNCTION DESCRIPTION

SOFTWARE - Store:

Prompts to elicit demographic, biographic, and decision style data

Prompts to elicit level of perception

Prompts to elicit assumptions made

Prompts to elicit data/relationship assimilation

Prompts to elicit individual preference for: level of detail, accuracy level, access time, solution time, data masking, and data organization (format, grouping, and level of detail)

Provision to control the above characteristics of data access

Display menu and formats

Decision tasks and associated scenario. Scenario = a combat model generated history of an emerging tactical situation, i.e., a sequence of situations. Subject can access "current" situation or earlier situations by specifying "as of" time.

Generates displays selected by experimenter and displays requested by subject, but latter are subject to controls imposed by experimenter.

EXPERIMENTER - Selects prompts, tasks and scenario

Sets controls on:

- level of detail in subject displays
- accuracy of data displayed to subject
- subject access time to displays
- solution time allowed subject
- masking of selected data classes
- display organization (level of detail, format, grouping)

- display sequence

Turns subject display "on" or "off"

SUBJECT - Generates responses to prompts and tasks
Selects displays
Generates displays
Selects elementary decision aids (terrian analysis, weapon coverage, sensor coverage, etc.)
Controls future sensor coverage (access to data base)

SOFTWARE

- Records all interface data
- Post-processes interface data to produce outputs

INPUT

- All prompts described under first software function above
- Decision tasks to be performed by subject
- Scenarios providing data needed to perform assigned tasks
- Display formats
- Display menu

INTERFACES (ITF)

1 - All displays generated as a result of prompts, tasks, scenario and controls selected by experimenter (ITF4); display menus and displays selected by, displays generated by and responses entered by subject (ITF6)

2 - Subject selected and generated menus and displays, but subject to controls imposed by experimenter (ITF4); subject generated responses and assumptions

3 - Record of ITF1 and ITF2

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1MP5, (Contd)

4 - Experimenter selection of:

- Prompts to be displayed
- Tasks to be presented
- Scenario to be accessed for reference
- Control level for:
  - level of detail in subject display
  - accuracy of data displayed to subject
  - subject access time to displays
  - solution time allowed subject
  - masking of selected data classes
  - display organization (level of detail, format, grouping)
  - display sequence
  - subject display "on" or "off"

NOTE: Experimenter can interrupt and override display selected by subject; such interruption simultaneously stops the scenario until experimenter starts it running again.

5 - Record of selections made at ITF4

6 - Subject selection or entry of:

- displays and data class menu
- self-generated displays
- elementary decision aids
- requests for change in future sensor coverage
- responses to prompts and tasks
- assumptions made

7 - Record of subject selections and entries at ITF6.

OUTPUTS

- Displays and data types selected per task
- Sequence of display and data type selection per task
- Level of detail authorized for each data class
- Cross-referencing per task
- Access time authorized for each display per task
- Response time per prompt
- Response times authorized per task and sub-task
- Level of perception for each perception prompt
- Demographic, biographic, and decision style data and classification into type of each
- Preference responses to preference prompts by task
- Assumptions made by task
- Data/relationship assimilation responses to prompts by task
- Solutions to each assigned task

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1ME6

FUNCTION DESCRIPTION

Same as R1MP5

INPUT

Same as R1MP5, PLUS

Flags on pre-selected critical events in scenario and keys to permit identification of subject responses to such critical events

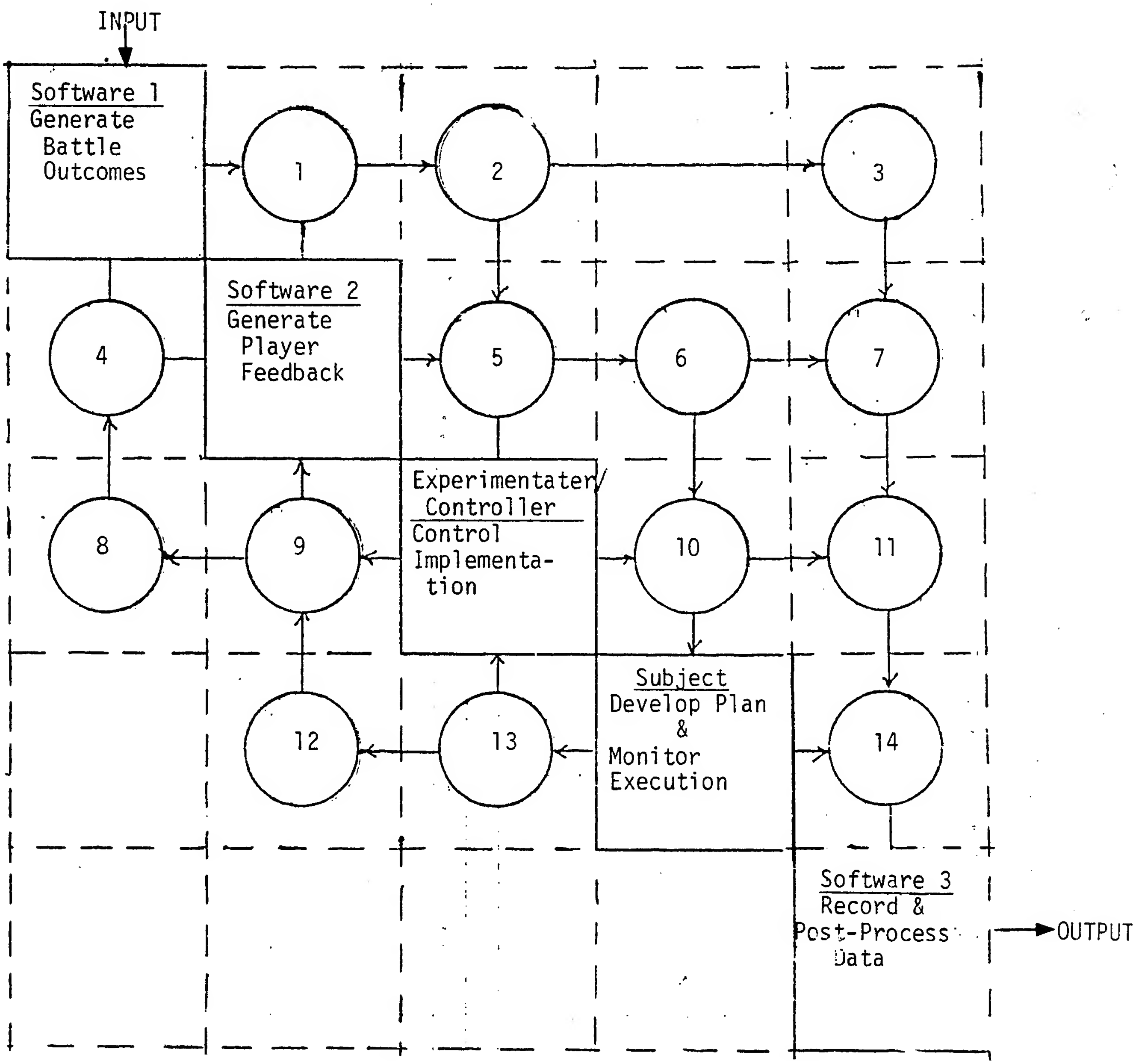
INTERFACES

Same as R1MP5

OUTPUTS

Same as R1MP5, PLUS

Response times for pre-selected critical events



N^2 CHART FOR EXPERIMENT CLASS NUMBER R1IB7

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R1IB7

FUNCTION DESCRIPTION

SOFTWARE 1:

- Generates Battle outcomes
- Maintains true data base

SOFTWARE 2:

- Generates subject data degraded in accordance with controls imposed by experimenter (ITF9)
- Generates all player displays

EXPERIMENTER/CONTROLLER:

- Sets control levels for Software 2
- Enters plan elements and orders received from subject (ITF13) and those generated by OPFOR
- Generates error messages to subject (ITF10) for illegal plans or orders
- Introduces prompts

SUBJECT:

- Generates plan elements and orders
- Requests information (menus and displays)
- Requests elementary decision aids
- Generates displays

SOFTWARE 3:

- Records ground truth history and all interface data
- Post-processes interface data to produce outputs

INPUT

- Forces, situation, and mission data needed to initiate planning and execution
- Displays menus

- Prompts to elicit the following frcm subject:
  - Level of perception
  - Assumptions made
  - Preference responses
  - Data/relationship assimilation
  - Demographic, biographic, and decision style data
- Flags and associated responses for key events

INTERFACES

1. Ground truth data needed to generate displays requested by subject
2. Ground truth data requested by experimenter/controller and acknowledgement of orders entered at ITF8
3. Record of ground truth history and all transactions at ITF1 and ITF2
4. Requests for ground truth needed to generate displays requested by subject (ITF12)
5. Any display requestable by subject at ITF12; all prompts requested at ITF9 and subject responses thereto
6. Displays and elementary decision aids requested or generated by subject (ITF12); all prompts requested at ITF9 and responses thereto.
7. Record of all transactions at ITF4, ITF5, and ITF6
8. Requests (via format) for ground truth displays
   Plan elements and orders generated by subject (ITF13) to be entered in battle outcome generator

   Experimenter selection of ratio of game time to real time
9. Experimenter selection of:
   - Minimum interval between subject requests for situation update
   - Number of data classes included in single update
   - Mode of presentation to subject (visual display or software generated audio) for selected data classes
   - Inaccuracies introduced into ground truth in subject displays

- Deliberate untruth substituted for ground truth in subject displays
- Distribution of delay times between "as of" time of ground truth and time presented to subject
- Initial situation used for planning and execution
- Display data organization (level of detail, format, grouping)
- Display symbology
- Prompts to be displayed to subject

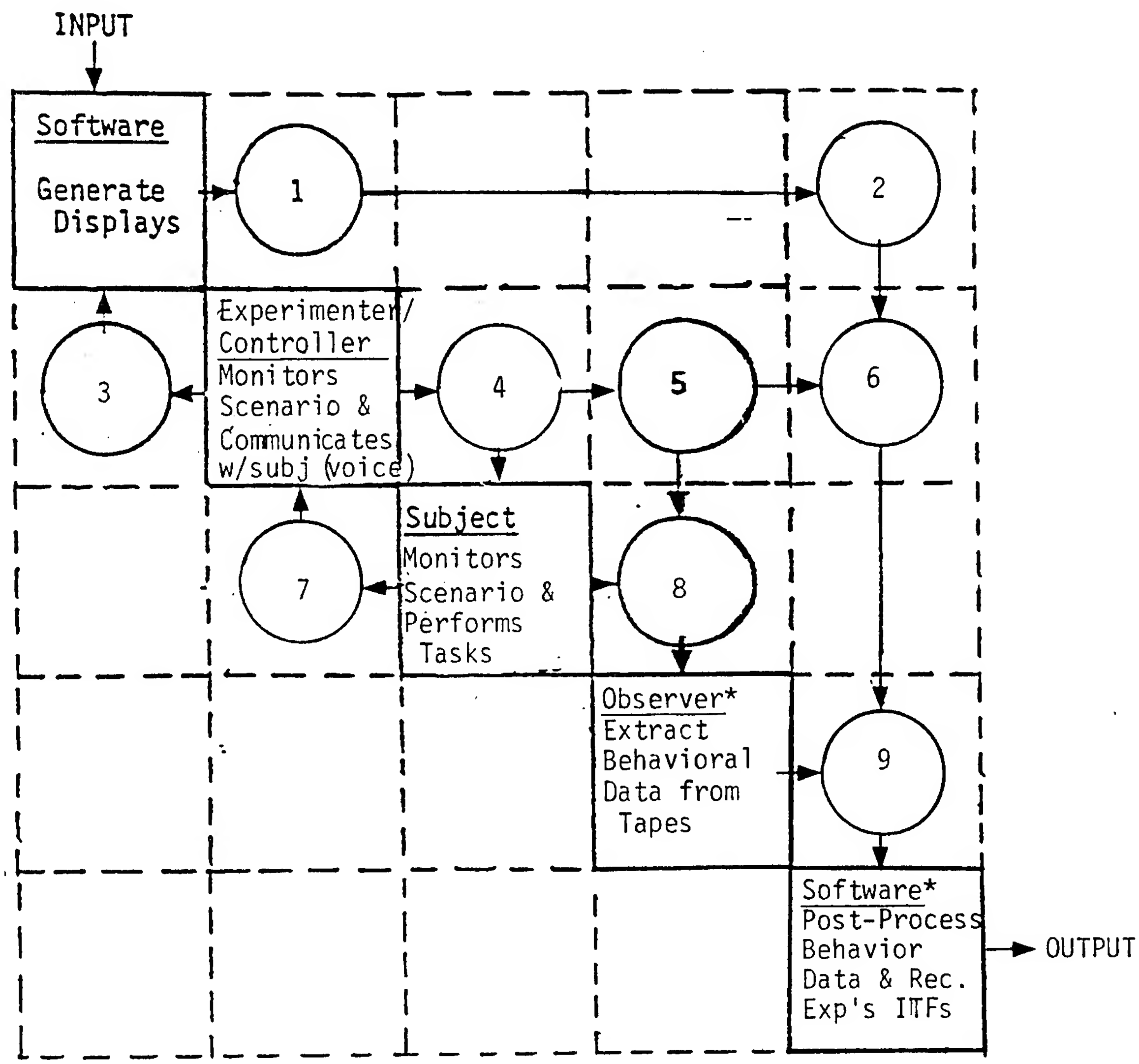
NOTE: Experimenter/controller can override display selected by subject to insert prompts; such interruption stops the game clock in Software 1 until experimenter starts it again.

10. Error messages to subject informing him of non-admissable plan elements or orders; acknowledgement of acceptable orders
11. Record of all transactions at ITF8, ITF9, and ITF10
12. Subject selection of:
    - Needed data (menus and displays)
    - Self-generated displays
    - Elementary decision aids
    - Responses to prompts
13. Subject generated plan elements and orders
14. Record of all transactions at ITF12 and ITF13

OUTPUTS

- Displays and data types selected by planning and execution
- Sequence of displays and data types selected by planning and execution
- Level of detail authorized/selected by planning and execution
- Cross-referencing by display

- Access time per display by planning and execution
- Response time per prompt
- Level of perception for each perception prompt
- Demographic, biographic, and decision type data and classification into type of each
- Preference responses to preference prompts by planning and execution
- Assumptions made by planning and execution
- Data/relationship assimilation responses to prompts by planning and execution
- Response times to pre-selected critical events
- Plans and orders generated
- Combat outcomes



*These functions & ITF9 are off-line except recording of experimenter's interfaces 1 & 3

N^2 CHART FOR EXPERIMENT CLASS NR R2MB8

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R2MB8

FUNCTION DESCRIPTION

SOFTWARE:

- Store display menus and formats
- Store decision tasks and associated scenarios
- Generate displays selected by experimenter. Experimenter can access "current" situation or earlier situations by specifying "as of" time.

EXPERIMENTER/CONTROLLER:

- Monitors scenario
- Communicates situation to subject via voice and hard copy

SUBJECT:

- Communicates with controller via voice and hard copy
- Communicates with other subjects via voice and hard copy
- Maintains files and displays
- Performs assigned tasks

OBSERVER: Reviews audio and video tapes and hard copy to extract internal subject data exchanges, data exchanges with controller, decision style and behavioral data. This function is performed off-line after experiment is over.

SOFTWARE:

- Records transactions at ITF2 and ITF6 on-line
- Performs statistical analyses of internal and external data exchanges, decision style and behavioral data off-line.

FUNCTION AND INTERFACE DESCRIPTION
EXPERIMENT CLASS NUMBER R2MB8 (Contd)

INPUT

- Decision tasks to be performed by subjects
- Scenarios providing data needed to perform assigned tasks
- Display menu
- Display formats

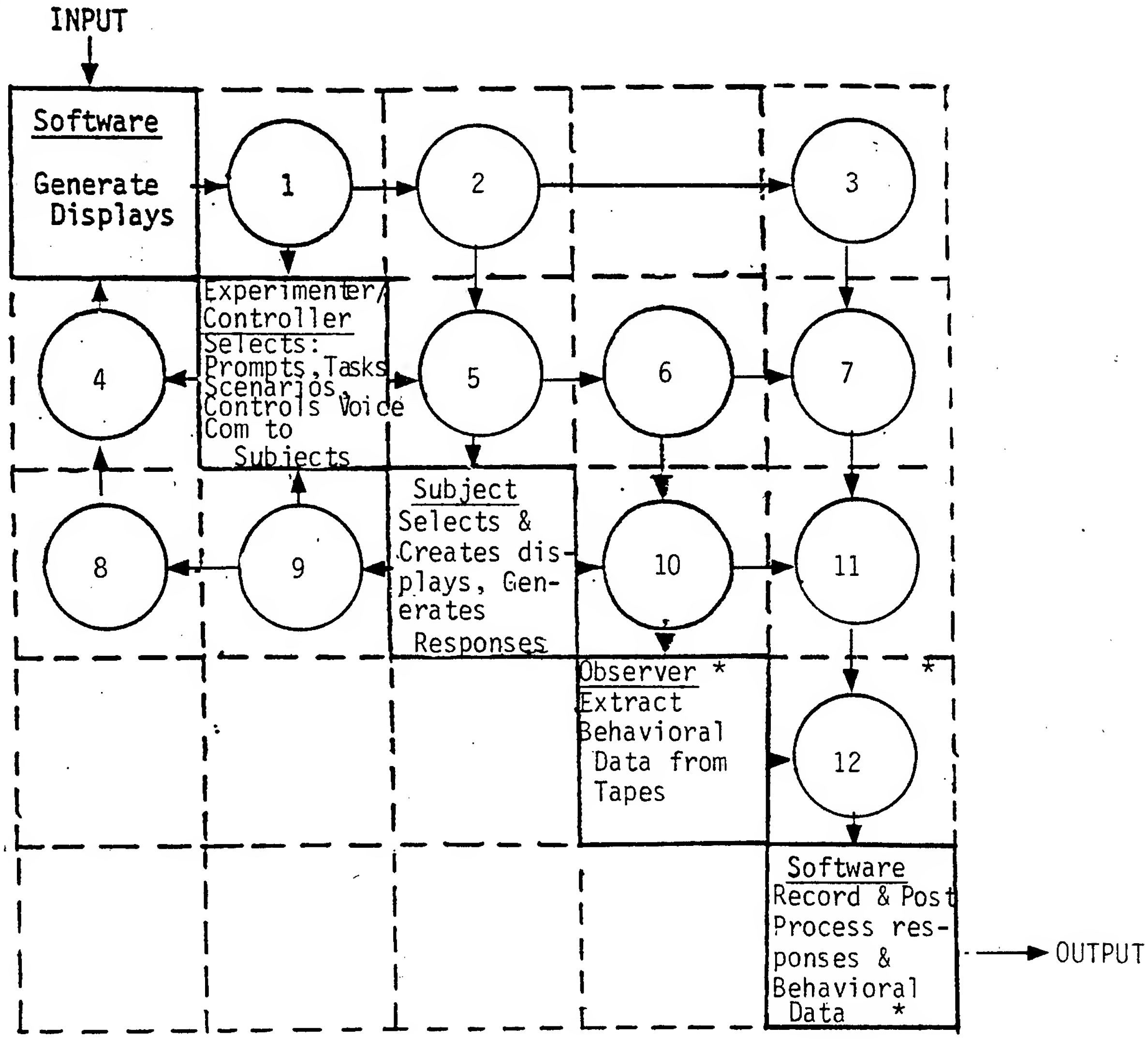
INTERFACES (ITF)

1. Displays and menus selected by experimenter/controller
2. Record of ITF1
3. Experimenter/controller selection of menus and displays, tasks to be performed and scenario to be accessed for reference

   Ratio of game time to real time
4. Voice and hard copy transfer of data on:
   - Emerging situation
   - Tasks to be performed
5. Audio recording of experimenter/controller voice transmissions and hard copy sent and received
6. Record of ITF3
7. Voice and hard copy transfer of data requesting and acknowledging information and providing solutions to assigned tasks
8. Video and audio recording of player actions and voice transmission of data internally and externally
9. Record of data exchanges (internal and external) decision style and behavioral data for statistical analysis.

OUTPUT

On-line record of experimenter transactions at ITF1 and ITF3
Statistical analyses of data exchanges, decision style, and behavioral data; solutions developed.



* Functions & ITF are off line

N^2 CHART FOR EXPERIMENT CLASS NR R2MB9 & R2MB10

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBERS R2MB9 AND R2MB10

FUNCTION DESCRIPTION

SOFTWARE - Store:

Prompts to elicit demographic, biographic, and decision style data

Prompts to elicit level of perception

Prompts to elicit assumptions made

Prompts to elicit data/relationship assimilation

Prompts to elicit individual preference for: level of detail, accuracy level, access time, solution time, data masking, and data organization (format, grouping, and level of detail)

Provision to control the above characteristics of data access

Flags and associated responses for key events

Display menus and formats

Decision tasks and associated scenarios. Scenario = a combat model generated history of an emerging tactical situation, i.e., a sequence of situations. Subject can access "current" situation or earlier situations by specifying "as of" time.

Generates displays selected by experimenter and displays requested by subject, but later are subject to controls imposed by experimenter.

EXPERIMENTER/CONTROLLER - Selects prompts, tasks, and scenario

Sets controls on:

- level of detail in subject displays
- accuracy of data displayed to subject
- subject access time to displays
- solution time allowed subject
- masking of selected data classes
- display organization (level of detail, format, grouping)
- display sequence

Turns subject display "on" or "off"

NOTE: If more than one terminal is installed for subject use, experimenter can impose controls listed at ITF4 either individually or collectively.

Communicates with subject via voice and hard copy

SUBJECT:

- Selects displays
- Generates displays
- Selects elementary decision aids (terrain analysis, weapon coverage, sensor coverage, etc.
- Generates responses to prompts and tasks
- Controls future sensor coverage (access to data base)
- Communicates with controller via voice and hard copy
- Communicates with other subjects via voice and hard copy

OBSERVER: Reviews audio and video tapes and hard copy to extract internal subject data exchanges with controller, decision style and behavioral data. This function is performed off-line after experiment is over.

SOFTWARE:

- Records all interface data
- Post-processes interface data to produce on-line outputs
- Performs off-line statistical analyses of observer records of internal and external data exchanges, decision style, and behavioral data

INPUT

- All prompts described under first software function above
- Decision tasks to be performed by subject
- Scenarios providing data needed to perform assigned tasks
- Display formats
- Display menus

INTERFACES

1. All displays generated as a result of prompts, tasks, scenarios, and controls selected by experimenter/controller (ITF4); display menus and displays selected by, displays generated and responses entered by subjects (ITF8)

2. Subject selected and generated menus and displays, but subject to controls imposed by experimenter (ITF4); subject generated responses and assumptions

3. Record of ITF1 and ITF2

4. Experimenter selection of:
   - Prompts to be displayed
   - Tasks to be presented
   - Scenario to be accessed for reference
   - Control lever for:
     - lever of detail in subject display
     - accuracy of data displayed to subject
     - subject access time to displays
     - solution time allowed subject
     - masking of selected data classes
     - display organization (level of detail, format, grouping)
     - display sequence
     - subject display "on" or "off"

NOTE: Experimenter can interrupt and override display selected by subject; such interruption simultaneously stops the scenario until experimenter starts it running again. Note also that experimenter exercise of controls listed above on an individual basis for multiple subject displays effectively forces selected inter-subject communications into voice mode.

5. Voice and hard copy transfer of data to subject
6. Audio recording of experimenter/controller voice transmissions and hard copy sent to subject and received from him
7. Record of ITF4 and ITF5
8. Subject selection or entry of:
    - displays and data class menu
    - self-generated displays
    - elementary decision aids
    - requests for change in future sensor coverage
    - responses to prompts and tasks
    - assumptions made
    - choice of inter-subject addressee
9. Voice and hard copy transfer of data requesting and acknowledging information and providing solutions to assigned tasks
10. Video and audio recording of player actions and voice transmission of data internally and externally
11. Record of ITF8
12. Record of data exchanges (internal and external) decision style and behavioral data for statistical analysis (off-line)

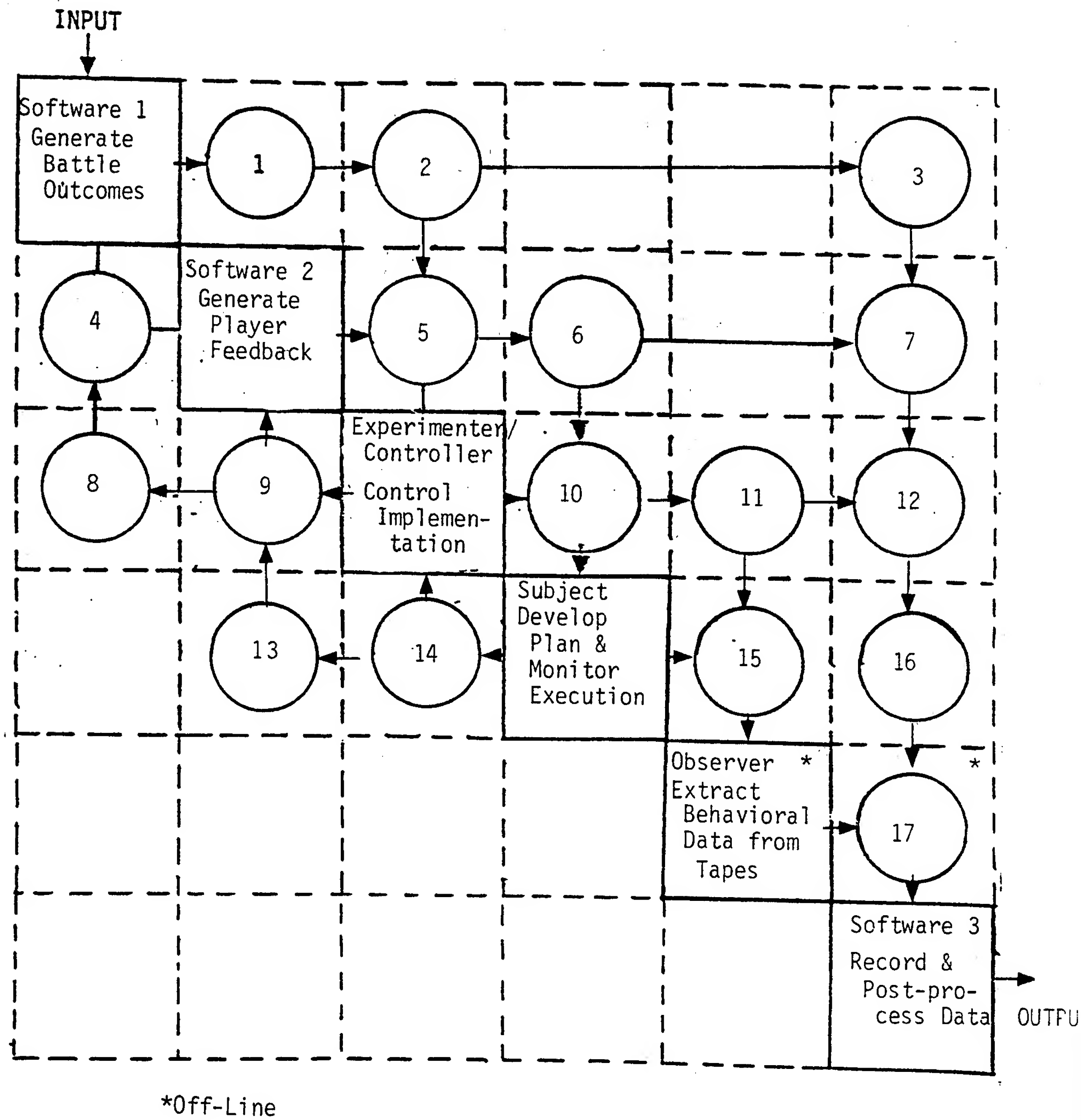
FUNCTION AND INTERFACE DESCRIPTION
EXPERIMENT CLASS NUMBERS R2MB9 and R2MB10 (Contd)

OUTPUT

- Displays and data types selected per task
- Sequence of display and data type selection per task
- Level of detail authorized for each data class
- Cross-referencing per task
- Access time authorized for each display per task
- Response time per prompt
- Response time authorized per task and sub-task
- Level of perception for each perception prompt
- Demographic, biographic, and decision style data and classification into type of each
- Response times to selected key events
- Solutions developed

Offline:

- Statistical analyses of data exchanges, decision style, and behavioral data
- Hardcopy solutions developed
- Communication errors



N^2 CHART FOR EXPERIMENT CLASS NUMBER R2IB11, R2IB12, R2IB13, R3IB14, R3IB15

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R2IB11

FUNCTION DESCRIPTION

SOFTWARE 1:

- Generates battle cutcomes
- Maintains true data base

SOFTWARE 2:

- Generates subject data degraded in accordance with controls imposed by experimenter (ITF9)
- Generates all subject displays

EXPERIMENTER/CONTROLLER:

- Sets control levels for Software 2
- Enters plan elements and orders received from subject (ITF14) and those generated by OPFOR
- Generates error messages to subject (ITF10) for illegal plans or orders
- Introduces prompts
- Communicates with subject via voice and hard copy

NOTE: If more than one terminal is installed for subject use, experimenter can impose controls listed at ITF9 either individually or collectively

SUBJECT:

- Generates plan elements and orders
- Requests information (menus and displays)
- Requests elementary decision aids
- Generates displays
- Generates responses
- Communicates with controller via voice and hard copy
- Communicates with other subjects via voice and hard copy

OBSERVER:

- Reviews audio and video tapes and hard copy to extract internal subject data exchanges, data exchanges with controller, decision style and behavioral data. This function is performed off-line after experiment is over.

SOFTWARE 3:

- Records ground truth history and all interface data (on line)
- Post-processes interface data to produce outputs (on line)
- Performs off-line statistical analyses of observer records of internal and external data exchanges, decision style and behavioral data.

INPUT:

- Forces, situation, and mission data needed to initiate planning and execution
- Displays and menus
- Prompts to elicit following from subjects
  - level of perception
  - assumptions made
  - preferences responses
  - data/relationship assimilation
  - demographic, biographic, and decision style data
- Flags and associated responses for key events

INTERFACES

1. Ground truth data needed to generate displays requested by subject
2. Ground truth data requested by experimenter/controller and acknowledgement of orders entered at ITF8

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER R2IB11 (Contd)

3. Record of ground truth history of all transactions at ITF1 and ITF2
4. Requests for ground truth needed to genrate displays requested by subject ITF13
5. Any display requestable by subject at ITF13; all prompts requested at ITF9 and responses thereto
6. Displays and elementary decision aids requested or generated by subject (ITF13; all prompts requested at ITF9) and responses thereto
7. Record of all transactions at ITF4, ITF5, and ITF6
8. Experimenter:
   - Requests (via format) for ground truth displays
   - Entry of plan elements and orders generated by subject (ITF14) into battle outcome generator
   - Selection of ratio of game time to real time
9. Experimenter selection of:
   - Minimum interval between subject requests for situation update
   - Number of data classes included in single update
   - Mode of presentation to subject (fisual display or software generated audio) for selected data classes
   - Inaccuracies introduced into ground truth in subject displays
   - Deliberate untruth substituted for ground truth in subject display
   - Distribution of delay times betwen "as of" time of ground truth and time presented to subject
   - Initial situation used for planning and execution
   - Display data organization (level of detail, format, grouping)
   - Display symbology
   - Prompts to be displayed to subject

NOTE: Experimenter can interrupt and override display selected by subject; such interruption stops the game clock in Software 1 until experimenter starts it again. Note also that experimenter exercise of controls listed above on an individual basis for multiple subject displays effectively forces selected inter-subject communications into voice mode.

10. Experimenter generated:
    - Error messages to subject informing him of non-admissable plan elements or orders
    - Acknowledgements of accepted plan elements and orders
    - Voice and hard copy transfer of data to subject
11. Audio recording of experimenter/controller voice transmissions and hard copy sent to subject and received from him
12. Record of ITF8, ITF9, and ITF10 (except voice)
13. Subject selection of:
    - Needed data (menus and displays)
    - Self-generated displays
    - Elementary decision aids
    - Responses to prompts
    - Assumptions made
    - Choice of inter-subject addressee (multiple terminals)
14. Voice and hard copy transfer of data requesting and acknowledging information and providing solutions to assigned tasks
15. Video and audio recording of player actions and voice transmission of data internally and externally
16. Record of ITF13 and ITF14
17. Record of data exchanges (internal and external), decision style and behavioral data for statistical analysis (off line)

- Demographic, biographic, and decision type data and classification into type of each
- Preference responses to preference prompts by planning and execution
- Assumption made by planning and execution
- Data/relationship assimilation responses to prompts by planning and execution
- Response times to pre-selected critical events
- Plans and orders generated
- Combat outcomes
- Offline statistical analysis of:
  - data exchanges
  - decision style
  - behavioral data
  - communication errors
  - hardcopy solutions developed

OUTPUTS:

- Displays and data types selected by planning and execution
- Sequences of displays and data types selected by planning and execution
- Level of detail authorized/selected by planning and execution
- Cross-referencing by display
- Access time per display by planning and execution
- Response time per prompt
- Level of perception for each perception prompt

FUNCTION AND INTERFACE DESCRIPTION
EXPERIMENT CLASS NUMBER R2IB12 and R1IB13

All functions, inputs, interfaces, and outputs are identical to R2IB11.

FUNCTION AND INTERFACE DESCRIPTION
EXPERIMENT CLASS NUMBER R2IB14 and R2IB15

SOFTWARE 1: Same as R2IB11

SOFTWARE 2: Same as R2!B11 PLUS

Additional software which provides advanced decision aids which will:

- Produce large unit movement plans
- Project expected combat outcomes to determine sensitivity to:
  - alternative stock levels and supply rates
  - alternative strength levels and replacement rates
  - alternative friendly courses of action
  - alternative enemy capabilities
- Identify courses of action which satisfy selected "win" criteria
- Identify enemy capabilities which best satisfy enemy "win" criteria

EXPERIMENTER/CONTROLLER: Same as R2IB11

SUBJECT: Same as R2IB11 PLUS

- Request advanced decision aids

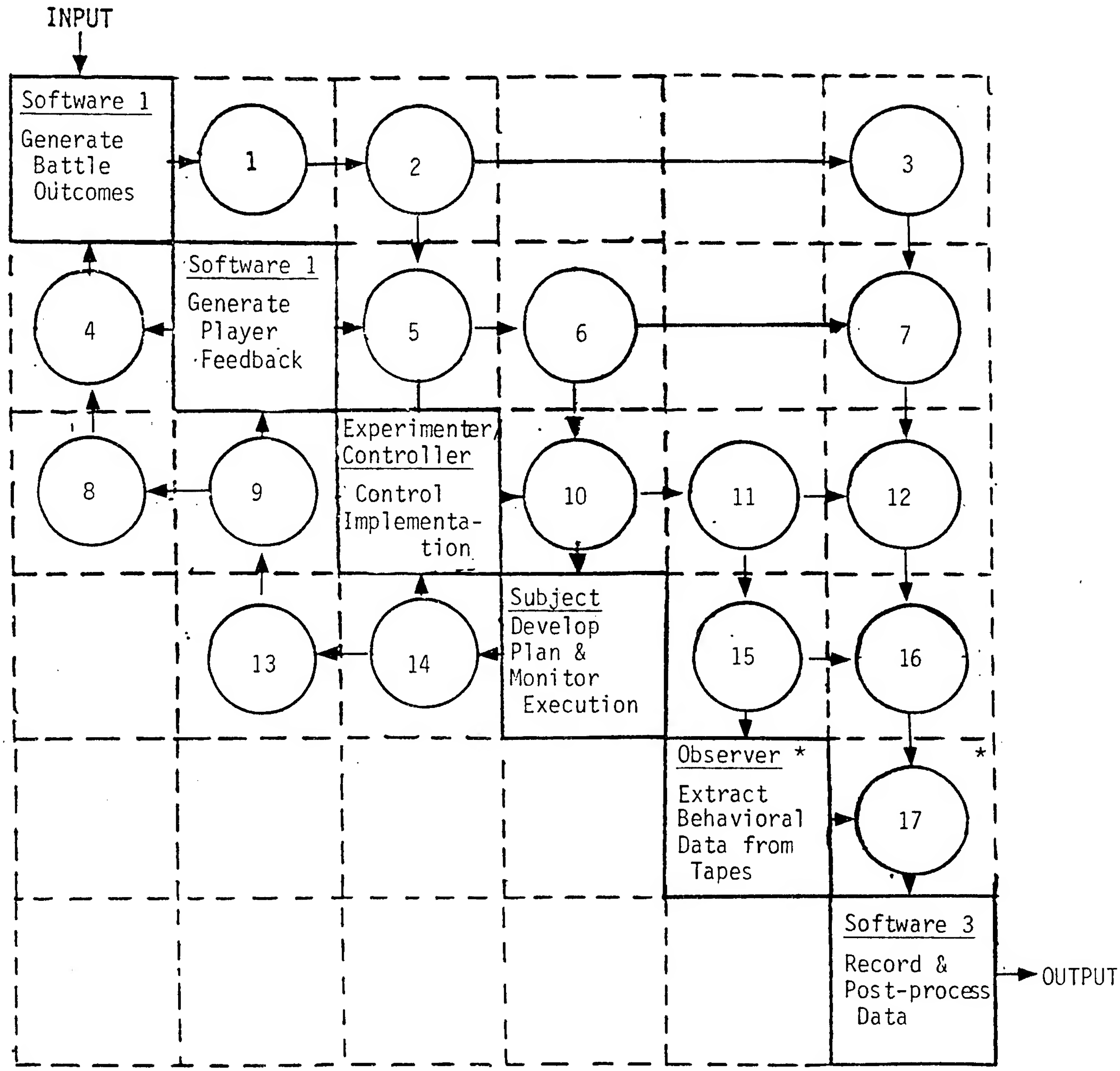
OBSERVER: Same as R2IB11

SOFTWARE 3: Same as R2IB11

INPUT: Same as R2IB11

INTERFACES: 1 through 12: Same as R2IB11
13; Same as R2IB11, but add advanced decision aids
14 through 17; Same as R2IB11

OUTPUTS: Same as R2IB11



*OFF-LINE

N[2] CHART FOR EXPERIMENT CLASS NUMBER T2IB16

FUNCTION AND INTERFACE DESCRIPTION
EXPERIMENT CLASS NUMBER T2IB16

FUNCTION DESCRIPTION: Same as R2IB11

INPUT: Same as R2IB11

INTERFACES:

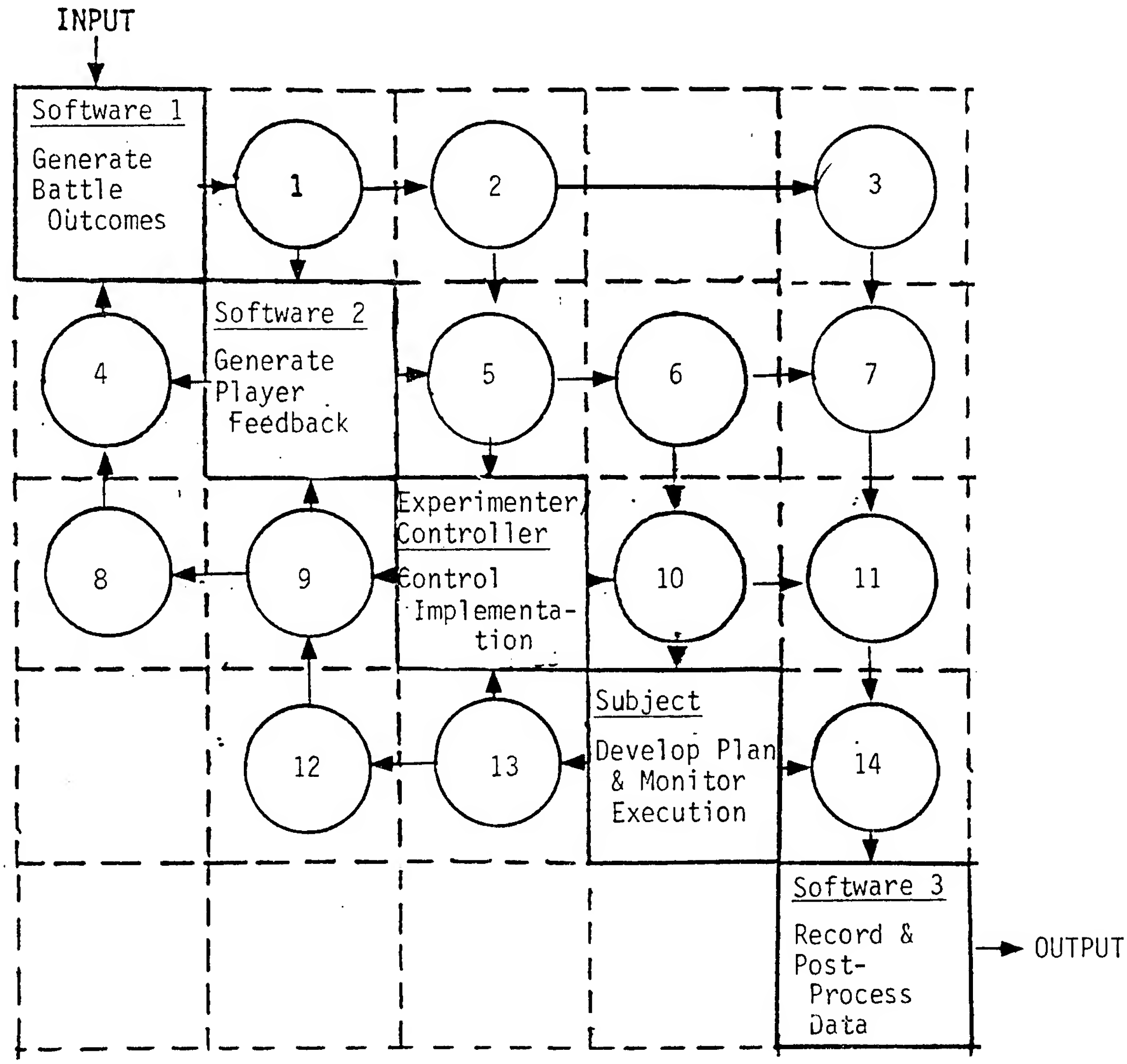
1 through 7: Same as R2IB11

8. Experimenter:

- Requests (via format) for ground truth displays
- Entry of plan elements and orders generated by subject (ITF14) into battle outcome Generator (SOFTWARE 1)
- Selection of ratio of game time to real time
- Selection of level of resolution in battle outcome generator

9 through 17: Same as R2IB11

OUTPUTS: Same as R2IB11



N^2 CHART FOR EXPERIMENT CLASS NUMBER T1IB17

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER T1IB17

FUNCTION DESCRIPTION

SOFTWARE 1:

- Generates battle outcomes
- Maintains true data base

SOFTWARE 2:

- Generates subject data in accordance with controls imposed by experimenter (ITF9)
- Generates all player displays
- Automatically generates training feedback messages upon receipt of selected subject inputs at ITF12 or ITF9 (e.g., "You haven't looked at POL status of that unit")

EXPERIMENTER/CONTROLLER:

- Sets control levels for Software 2
- Enters plan elements and orders received from subject (ITF13) and those generated by OPFOR
- Generates error messages to subject (ITF10) for illegal plans or orders
- Introduces prompts
- Introduces training feedback messages to subject (e.g., "you have not considered available terrain data for that sector")

SUBJECT:

- Generates plan elements and orders
- Requests information (menus and displays)
- Requests elementary decision aids
- Generates displays

SOFTWARE 3:

- Records ground truth history and all interface data
- Post-process interface data to produce outputs

NOTE: Experimenter/controller uses output data to construct more training feedback to subject, off-line

INPUT

- Forces, situation, and mission data needed to initiate planning and execution
- Displays and menus
- Prompts to elicit following from subject:
  - level of perception
  - assumptions made
  - preference responses
  - data/relationship assimilation
  - demographic, biographic, and decision style data
- Flags and associated responses for key events
- Training feedback responses for selected combinations of subject input

INTERFACES:

1. Ground truth data needed to generate displays requested by subject
2. Ground truth data requested by experimenter/controller and acknowledgement of orders entered at IF8
3. Record of ground truth history and all transactions at ITF1 and ITF2
4. Requests for ground truth needed to generate displays requested by subject (ITF12)
5. Any display requestable by subject at ITF12; all prompts requested at ITF9 and subject responses thereto; all training feedback messages generated by Software 2 or Experimenter/controller
6. Displays and elementary decision aids requested or generated by subject (ITF12); all prompts requested at ITF9 and responses thereto; all training feedback messages
7. Record of all transactions at ITF4, ITF5, and ITF6
8. Requests (via format) for ground truth displays; plan elements and orders generated by subject (ITF13) for entry into battle outcome generator; selection of ratio between game time and real time

9. Experimenter selection of:

   - Minimum interval between subject requests for situation update
   - Number of data classes included in single update
   - Mode of presentation to subject (visual display or software generated audio) for selected data classes
   - Inaccuracies introduced into ground truth in subject displays
   - Deliberate untruth substituted for ground truth in subject display
   - Distribution (variance) of delay times between "as of" time of ground truth and time presented to subject
   - Initial situation used for planning and execution
   - Display data organization (level of detail, format, grouping)
   - Display symbology
   - Prompts to be displayed to subject
   - Training feedback messages to subject

   NOTE: Experimenter/controller can override display selected by subject to insert prompts or training feedback; such interruption stops the game clock in Software 1 until experimenter starts it again.

10. Error messages to subject informing him of non-admissable plan elements or orders; acknowledgement of acceptable orders

11. Record of all transactions at ITF8, ITF9, and ITF10

12. Subject selection of:

    - Needed data (menus and displays)
    - Self-generated displays
    - Elementary decision aids
    - Responses to prompts

13. Subject generated plan elements and orders

14. Record of all transactions at ITF12 and ITF13

OUTPUTS

- Displays and data types selected by planning and execution

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER T1IB17 (Contd)

- Sequence of displays and data types selected by planning and execution
- Level of detail authorized/selected by planning and execution
- Cross-referencing by display
- Access time per display by planning and execution
- Response time per prompt
- Level of perception for each perception prompt
- Demographic, biographic, and decision type data and classification into type of each
- Preference responses to preference prompts by planning and execution
- Assumptions made by planning and execution
- Data/relationship assimilation responses to prompts by planning and execution
- Response times to pre-selected critical events
- Plans and orders generated
- Combat outcomes

N^2 CHART FOR EXPERIMENT CLASS NUMBER T2IB18:

Same as R2IB11 except delete Interface 14

FUNCTIONS AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER T2IB18

FUNCTION DESCRIPTION

SOFTWARE 1: Same as R2IB11

SOFTWARE 2: Same as R2IB11 PLUS:

- Automatically generates training feedback messages upon receipt of selected subject inputs at ITF12 or ITF9

EXPERIMENTER/CONTROLLER: Same as R2IB11 PLUS:

- Introduces training feedback messages to subject

SUBJECT: Same as R2IB11

OBSERVER: Same as R2IB11

SOFTWARE 3: Same as R2IB11 PLUS:

NOTE: Experimenter/controller uses output data to construct more training feedback to subject, off-line

INPUT: Same as R2IB11 PLUS:

- Training feedback responses for selected combinations of subject input

INTERFACES: 1 through 4: Same as R2IB11

5. Same as R2IB11 PLUS:

   all training feedback messages generated by Software 2 or experimenter/controller

6. Same as R2IB11 PLUS:

   all training feedback messages

7 and 8. Same as R2IB11

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER T1IB17 (Contd)

9. Same as R2IB11 PLUS:

   training feedback messages to subject

10. Same as R2IB11 EXCEPT:

    DELETE: Voice and hard copy transfer of data to subject

11 through 13: Same as R2IB11

14. Delete this interface

15 through 17: Same as R2IB11

OUTPUTS:

Same as R2IB11

N^2 CHART FOR EXPERIMENT CLASS NUMBER T2IB19 and T2IB20

Same as for R2IB11

FUNCTIONS AND INTERFACE DESCRIPTION
EXPERIMENT CLASS NUMBER T2IB19 and T2IB20

FUNCTION DESCRIPTION

SOFTWARE 1: Same as R2IB11

SOFTWARE 2: Same as R2IB11 PLUS:

- Automatically generates training feedback messages upon receipt of selected subject inputs at ITF12 or ITF9

EXPERIMENTER/CONTROLLER: Same as R2IB11 PLUS:

- Introduces training feedback messages to subject

SUBJECT: Same as R2IB11

OBSERVER: Same as R2IB11

SOFTWARE 3: Same as R2IB11 PLUS:

NOTE: Experimenter/controller uses output data to construct more training feedback to subject, off-line

INPUT: Same as R2IB11 PLUS:

- Training feedback responses for selected combinations of subject input

INTERFACES

1 through 4: Same as R2IB11

5. Same as R2IB11 PLUS:

all training feedback messages generated by Software 2 or experimenter/controller

6. Same as R2IB11 PLUS:

all training feedback messages

7. & 8. Same as R2IB11

9. Same as R2IB11 PLUS:

- training feedback messages to subject

10 through 17: Same as R2IB11

OUTPUTS: Same as R2IB11

EXPERIMENT CLASS NUMBER T1IB21:

N^2 Chart, Functions, Inputs, Interfaces, and Outputs are all the same as R1IB7, but hardware and software incorporate advanced technology such as:

- micro computers
- video disks
- voice interactive devices
- artificial intelligence programming
- adaptive programming

EXPERIMENT CLASS NUMBER C1MB22:

N^2 CHART: Same as R2MB9 and R2MB10

FUNCTION DESCRIPTION

SOFTWARE: Same as R2MB9

EXPERIMENTER/CONTROLLER: Same as R2MB9 EXCEPT: delete NOTE

SUBJECT: Same as R2MB9 EXCEPT delete:

- Communicates with other subjects via voice and hard copy

OBSERVER: Same as R2MB9

SOFTWARE: Same as R2MB9

INPUT: Same as R2MB9

INTERFACES

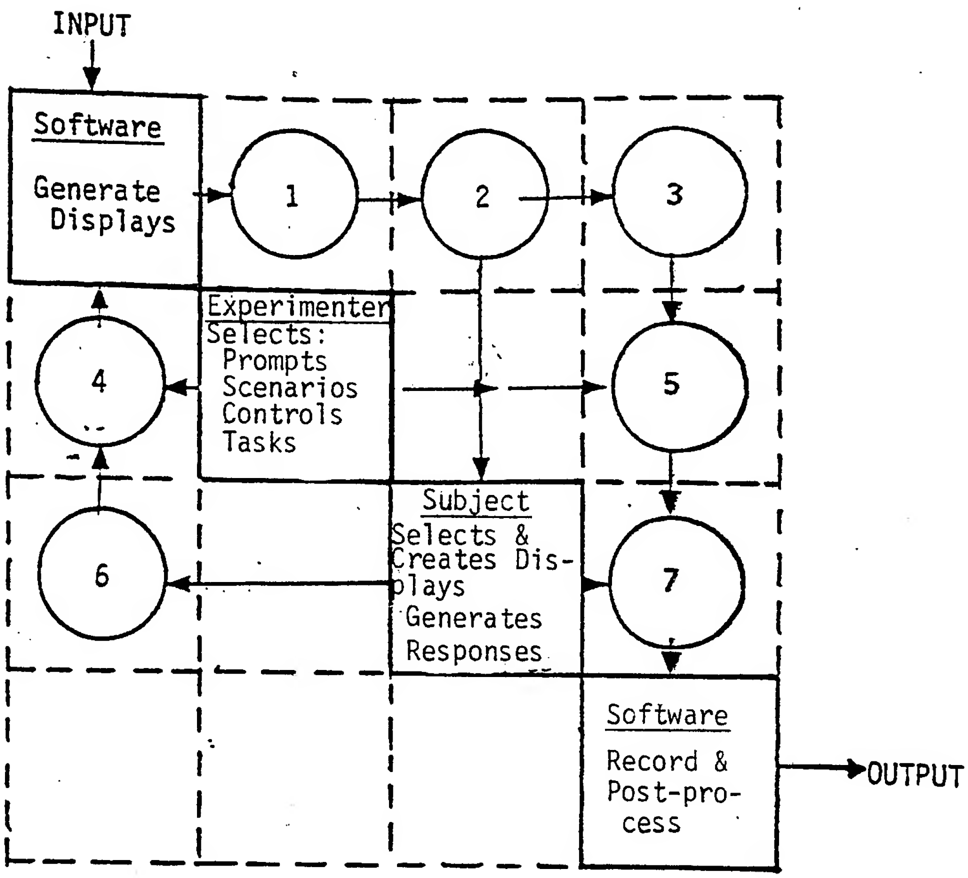
1 through 3: Same as R2MB9

4. Same as R2MB9 EXCEPT delete second sentence of NOTE

5. through 12: Same as R2MB9

OUTPUT: Same as R2MB9 PLUS add:

NOTE: Experimenter uses above outputs to develop alternative after action summaries; these may involve additional software.



N^2 CHART FOR EXPERIMENT CLASS NUMBER C1MB23

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER C1MB23

FUNCTION DESCRIPTION

SOFTWARE - Store:

- Prompts to elicit demographic, biographic, and decision style data
- Prompts to elicit level of perception
- Prompts to elicit assumptions made
- Prompts to elicit data/relationship assimilation
- Prompts to elicit preference for: nomographs for admin/log; speech, touch panel, mouse, track ball, or light pen for data entry; speech synthesis; selective shift of controller tasks to the computer
- Provision to control the above modes of data transfer
- Scenarios. Scenario = a sequence of tactical situations to include the accompanying record of player generated plan elements and orders and the resulting plan elements and orders entered into the battle outcome generator by the controller. Records generated by Experiment Class Nr. R1IB7, R2IB11, R2IB12, R2IB13, R3IB14, and R3IB15 are suitable.
    - Generates selected player plan elements and orders directly into inputs suitable for entry into a battle outcome generator
    - Generates displays selected by the experimenter and displays requested or generated by the subject, but latter are subject to controls imposed by the experimenter.

EXPERIMENTER - Selects scenario and prompts

- Selects mode of data transfer to and from subject
- Selects classes of plan element and orders which will be processed by computer

SUBJECT - Generates responses to prompts

- Selects displays
- Generates displays
- Converts player plan elements and orders into battle outcome generator inputs

SOFTWARE - Records all interface data
- Post-processes interface data to produce outputs

INPUT

- All prompts described under first software function above
- Scenarios to include records described above
- Display formats
- Display menus

INTERFACES

1. All displays generated as a result of prompts, scenario and controls selected by experimenter (ITF4); display menus and display selected by, displays generated by and responses entered by subject (ITF6)
2. Subject selected and generated menus and displays, but subject to controls imposed by experimenter (ITF4); subject generated responses and assumptions
3. Record of ITF1 and ITF2
4. Experimenter selection of:
    - Prompts to be displayed
    - Types of plan elements and orders to be processed by computer
    - Scenario to be presented
    - Controls on subject data transfers:
        - nomographs for admin/log
        - alternative display logic and graphics
        - alternative data entry: speech, touch panel, mouse, track ball, light pen
        - speech synthesis

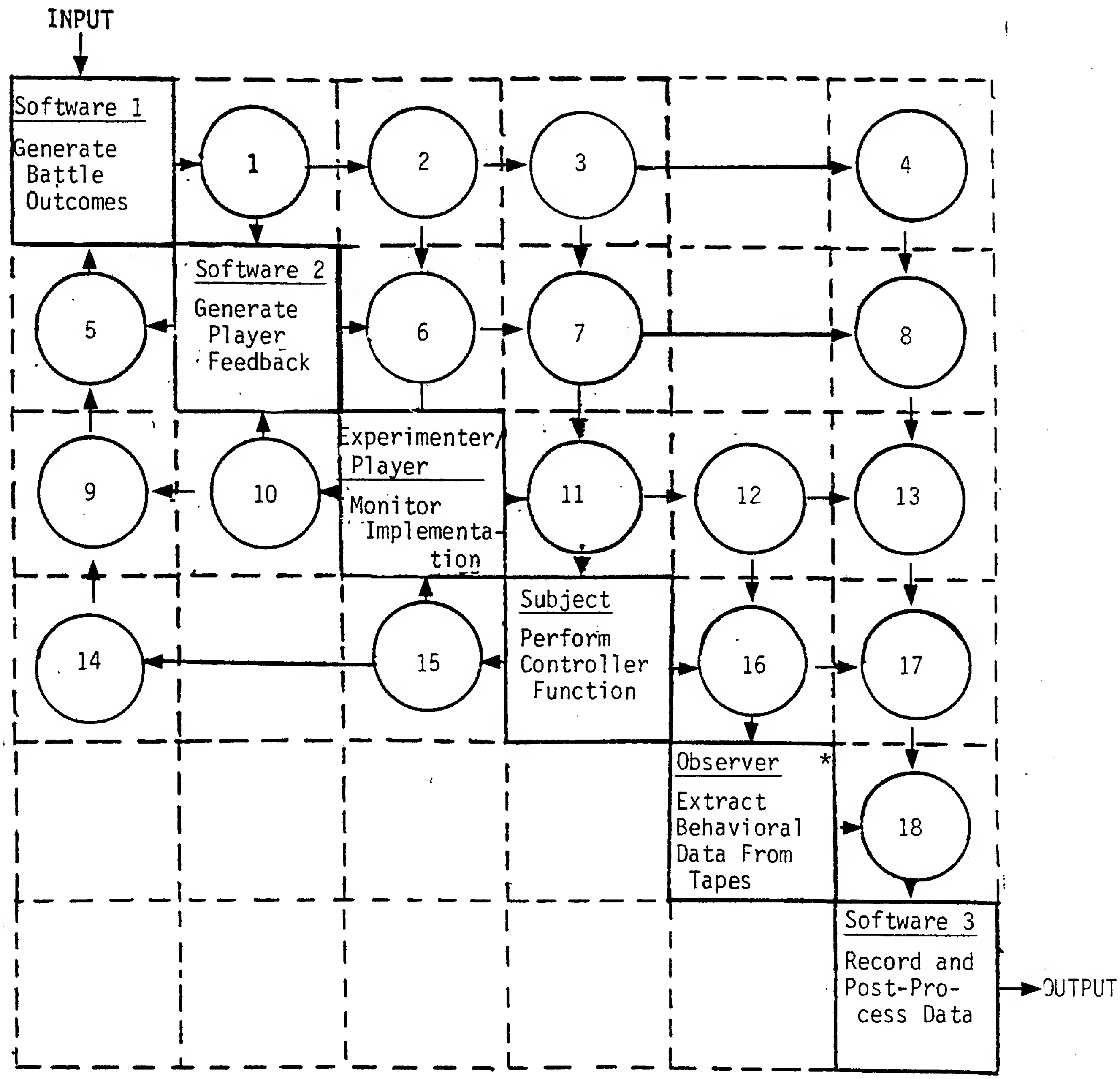
    NOTE: Experimenter can interrupt and override displays selected by subject; such interruption simultaneously stops the scenario until experimenter starts it running again.
5. Record of ITF4

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER C1MB23 (Contd)

6. Subject selection or entry of:
   - displays and menus
   - self-generated displays
   - responses to prompts
   - assumptions made
   - conversion of player entries into battle outcome generator inputs
7. Reocrd of ITF6

OUTPUTS

- Subject response times to player plans and orders presented
- Level of perception
- Assumptions made
- Demographic, biographic, and decision style data and classification into type of each
- Subject preference for alternative displays, data transfer mode, and division of labor with computer
- Comparison of:
  - subject generated battle outcome generator entries
  - computer generated battle outcome generator entries
  - original controller generated battle outcome generator entries



*OFF LINE

N^2 CHART FOR EXPERIMENT CLASS NUMBER C2IB24

FUNCTION AND INTERFACE DESCRIPTIONS
EXPERIMENT CLASS NUMBER C2IB24

FUNCTION DESCRIPTION

SOFTWARE 1:

- Generates battle outcomes
- Maintains true data base

SOFTWARE 2:

- Generates player data in accordance with controls imposed by experimenter (ITF10)
- Generates all player displays

EXPERIMENTER/PLAYER:

Experimenter:

- Sets control levels for Software 2
- Introduces prompts
- Selects mode of data transfer to and from subject
- Selects classes of plan elements and orders which can be introduced directly into Software 2 (controller functions performed directly by computer)

Player:

- Generates plan elements and orders
- Requests information (menus and displays)
- Requests elementary decision aids
- Generates displays
- Communicates with controller via voice and hard copy

SUBJECT:

- Generates responses to prompts
- Selects displays
- Generates displays
- Converts player plan elements and orders into inputs to Software 1

- Communicates with player via voice and hard copy
- Communicates with other subjects via voice and hard copy
- Generates error messages to player for illegal plans or orders

OBSERVER:

- Reviews audio and video tapes and hard copy to extract internal subject data exchanges, data exchanges with player, decision style and behavioral data. This function is performed off-line after experiment is over

SOFTWARE 3:

- Records ground truth data and all interface data (on-line)
- Post-processes interface data to produce outputs (on-line)
- Performs off-line statistical analyses of observer records of internal and external data exchanges, decision style and behavioral data

INPUT

- Forces, situation, and mission data needed to initiate planning and execution
- Displays and menus
- Prompts to elicit following from subject:
  - demographic, biographic, and decision style data
  - level of perception
  - assumtions made
  - preference for: nomographs for admin/log; speech, touch panel, mouse, track ball, or light pen for data entry; speech synthesis; selective shift of controller tasks to the computer

INTERFACES

1. Ground truth data needed to generate displays requested by player
2. Ground truth data requested by experimenter
3. Ground truth data requested by subject (controller) and acknowledgement of orders entered at ITF9; prompts requested by experimenter and responses

4. Record of ground truth history and all transactions at ITF1, ITF2, and ITF3

5. Requests for ground truth needed to generate displays requested by player at ITF10

6. Displays and decision aids requested or generated by player (ITF10)
   To experimenter only: all prompts requested at ITF9 and responses thereto

7. Any display requestable by player at ITF10

8. Record of all transactions at ITF5, ITF6, and ITF7

9. Experimenter selection of:

   - Prompts to be displayed
   - Types of plan elements and orders to be processed directly by Software 1
   - Scenario to be presented
   - Ratio of game time to real time
   - Controls on subject data transfers:
     - nomographs for admin/log
     - alternative display logic and graphics
     - alternative data entry: speech, touch panel, mouse, track ball, light pen
     - speech synthesis

   NOTE: Experimenter can interrupt and override display selected by subject; such interruption stops the game clock in Software 1 until experimenter starts it again.

   Direct entry into Software 1 of player generated plan elements and orders authorized by experimenter selection above

10. Experimenter selection of Software 2 parameters listed at ITF9 for R2IB11

    Player selection of:

    - Needed data (menus and displays)
    - Self-generated displays
    - Elementary decision aids

11. Voice and hard copy transfer of data from player to controller requesting and acknowledging information and providing solutions to assigned tasks

12. Video and audio recording of player actions and voice transmissions of data internally and externally
13. Record of ITF9 and ITF10
14. Subject selection or entry of:
    - Displays and menus (gound truth)
    - Self-generated displays
    - Responses to prompts
    - Assumptions made
    - Conversion of player entries into inputs to Software 1
    - Choice of inter-subject addressees
15. Controller generated
    - Error messages to player informing him of non-admissable plan elements or orders
    - Acknowledgements of accepted plan elements and orders
    - Voice and hard copy transfer of data to player
16. Video and audio recording of subject actions and voice transmissions of data internally and externally
17. Record of ITF14 and ITF15 (non-voice)
18. Record of data exchanges (internal and external), decision style and behavioral data for statistical analysis (off-line)

<u>OUTPUTS</u>

- Subject response times to player plans and orders
- Level of perception
- Assumptions made
- Demographic, biographic, and decision style data and classification into type of each
- Subject preference for alternative displays, data transfer mode, and division of labor with computer
- Data/relationship assimilation
- Communication errors both inter-subject and inter-system
- Subject generated battle outcome generator entries
- Battle outcomes
- Off-line statistical analysis of:
    - data exchanges, decision style, behavioral data communication data, and hardcopy solutions developed

EXPERIMENT CLASS NUMBER T1IB25

N^2 Chart, Functions, Inputs, Interfaces, and Outputs are all the same as T2IB16, but Software 2 has incorporated significant additional software. For this experiment class, Software 2 must not only present a credible view of the ongoing battle as the staff as a whole would see it, but must present a credible view of what a single staff section would see. This means that the information processing and actions (to include decisions) of the other staff sections not being represented by the subject must be simulated. This will involve some rather complex artificial intelligence programs. See para 2.3.3, page 2-38 of AIR Proposal, "Design of a Modular Laboratory for Research on Tactical C^2" for a more detailed description of the functional requirement. Note that T1IB25 is applicable only for experiments at echelons above battalion.

EXPERIMENT CLASS NUMBER C3MB26

N^2 Chart, Functions, Inputs, Interfaces, and Outputs are all the same as R2IB14 and R2IB15, but Software 2 has been futher augmented to permit subject construction of many additional "if" questions and the generation of suitable responses (usually by extrapolating battle situations and processes to future times) by Software 2 and displaying such responses to the subject.

9352

WORKING PAPER LVN 92-02

Army Command and Control Evaluation System (ACCES): Application Manager's Guide

Prepared by:
Evidence Based Research, Inc.
Vienna VA

January 1992

Reviewed by: DOUGLAS K. SPIEGEL
Performance Measurement Team; Contracting Officer's Representative

Approved by: STANLEY M. HALPIN
Chief, Fort Leavenworth Field Unit

Cleared by: ZITA M. SIMUTIS
Director,
Manpower and Personnel Research Division

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

ACCES Application Managers Guide

Introduction

This guide describes the steps to be taken in preparing for and executing an ACCES application. Although, in the interest of clarity, the descriptions here are quite specific, the steps listed can and should be modified to meet unique exercise plans, objectives, schedules, or other requirements. For example, this guide is written as through the target unit were a division, but the system works equally well for corps- and brigade- level applications. Care should be taken not to delete any step, because each has proven to be necessary in the successful completion of past applications. Figure 1 gives an overview of the steps organized into five groups of interrelated activities:

1. establishing the application framework;
2. adapting measurement and observation schemes to the exercise;
3. preparing for the exercise;
4. data collection and reduction ; and,
5. analysis, final report, and archiving of data.

The ideal exercise for an ACCES application is designed specifically to evaluate division-level command and control (C2). In practice however, ACCES is more likely to be employed during an exercise conducted for other reasons, particularly training or evaluation of new equipment, procedures, doctrine or organization. While this imposes constraints on ACCES, the flexible structure of the methodology still allows a highly successful application.

Establishing the Application Framework

In this initial step of an ACCES application, the scope and objectives of the exercise are reviewed to define the focus of the ACCES application, and coordination is sought with the exercise scenario.

Identify Exercise Objectives

ACCES may be applied for a variety of reasons, ranging from unit development to assessing the impact of a change in the C2 system (doctrine, processes, people, or equipment). To plan a successful application, the ACCES manager must understand these goals. This understanding is needed to select measures, position observers, identify key data, coordinate with the scenario, and design feedback (reports and briefings). It is particularly important to know which C2 functions are being addressed.

Introduce User to ACCES

An ACCES application depends for its success on the ability of observers to be reasonably close to the decision maker(s) or senior staff member(s) during exercise–related discussions. The ACCES manager must also ensure that the user knows enough about ACCES to take full advantage of the system. Meeting these two goals

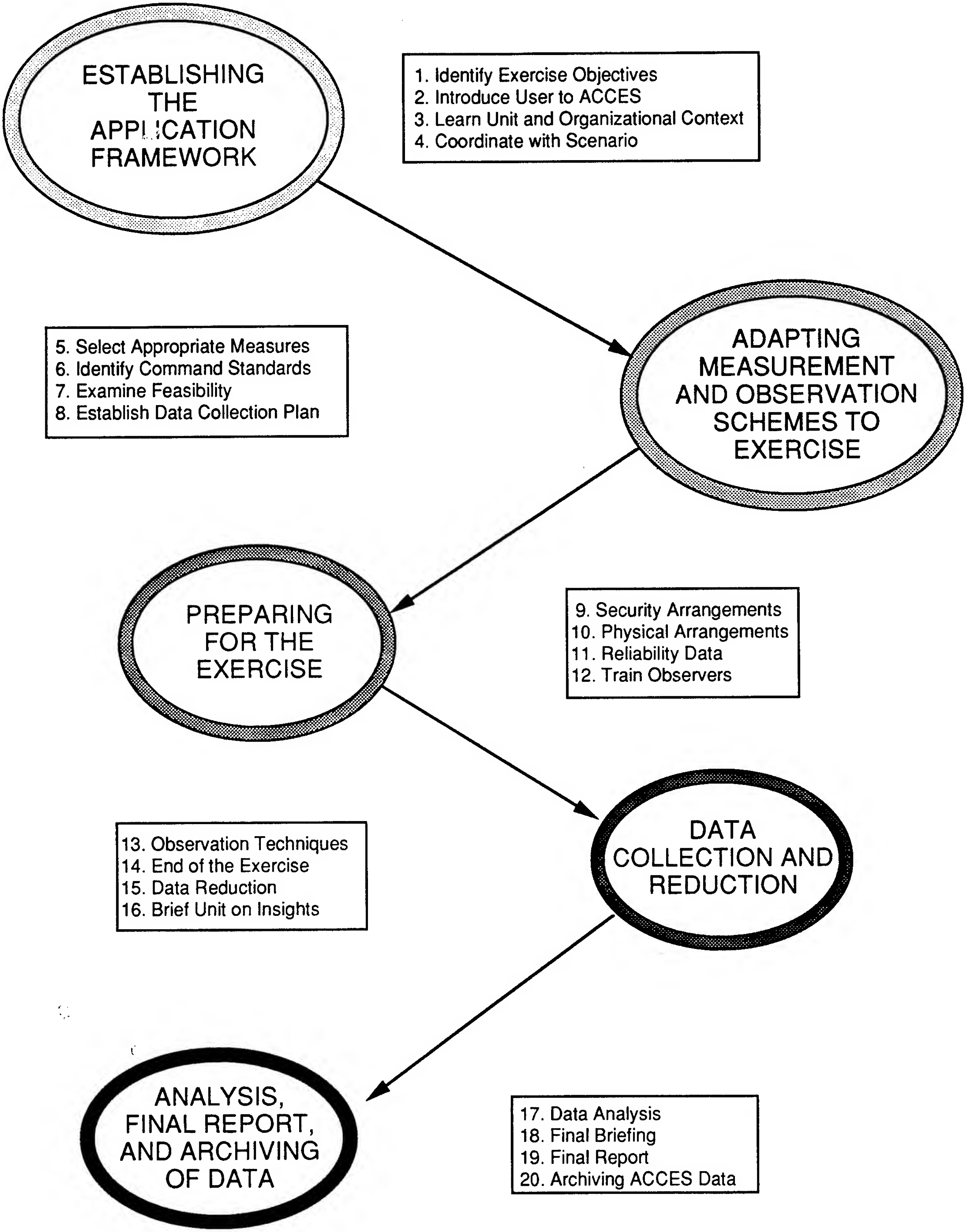


Figure 1. ACCES Application Process

requires meeting with the commander or his designated representative to discuss their objectives; making clear the types of information, access, and support necessary for a successful application, the kind of reports they can expect; and briefing all elements of the command early in the planning process on the purpose and nature of the ACCES application. At a minimum, this briefing should include:

1. the nature and general theory of ACCES;
2. what ACCES provides to the command;
3. how observation and data collection will affect the CPs;
4. arrangements for collection of exercise–generated data; and
5. how ACCES will be reported.

Properly conducted, this step contributes greatly to the success of the effort.

Note that the framework for a successful ACCES application cannot be established without direct discussions with the exercise controllers. They are the only ones who know the specific objectives being pursued. They control the scenario. They decide the organizational context for the exercise (how corps and brigades will be represented, what type of adversary will be played, what augmentations and support the unit will have, what allied forces they will need to coordinate with for what functions, etc.)

At the same time, the ACCES team should use these preliminary interactions to explain ACCES to the unit and to the exercise controllers. This includes establishing the principles of working together, access to the exercise, lack of threat to the unit, and agreement on what is to be reported. Indeed, expectations need to be both created and managed.

Learn Unit and Organizational Context

The ACCES team managers must understand the unit type (infantry, armor, or mechanized) that is receiving the ACCES application and also the organizational characteristics of this unit (battalion names, types of battalions or brigades, and how they are equipped [e.g. M3 Bradleys or APC's, automated C2 equipment or none]).

Coordinate with Scenario

From an ACCES viewpoint, the ideal situation would be to have an exercise scenario which ensures that all levels of command will be forced to operate, at one time or another, under all three levels of stress (i.e., high, medium, and low) and which will involve high stress on all Division C2 functions. One way for this to be accomplished is for the ACCES team to be actively involved in developing the scenario. Another is to select specific scenario events that are expected to stimulate desired C2 responses. These events can be identified to the observer as key events to be tracked in in detail. The critical point is that no headquarters or function for which meaningful evaluation is desired should be allowed to remain at low or moderate stress, since past experience indicates that high stress periods provide key information about C2 performance and effectiveness.

Adapting Measurement & Observation Schemes to the Exercise

The key element of this initial data collection planning is balancing the desirable (in terms of measures to be employed) against the feasible (in terms of available assets).

Select Appropriate Measures

Once the exercise objectives have been defined for a particular application, the individual staff tasks that support each objective are identified, and the applicable ACCES measures are identified. This allows the team to match the data categories and data elements of interest with applicable sections of the division Field Standard Operating Procedures (FSOP), Army doctrine, and other guidance. ACCES involves a number of measures. Not all are applicable to all purposes. Selecting the correct measures both reduces later work and focuses the application on key aspects of C2, hopefully those related to the exercise objective.

Identify Command Standards

After selecting the ACCES measures to be used for the application, those requiring command standards (Friendly Status Report [FSR] and Intelligence Summary [INTSUM] Punctuality/Lateness and Completeness) should be noted and necessary standards identified. In some cases, these standards will not exist and will have to be developed by the ACCES team in conjunction with the division staff or exercise controllers. Once the measures have been selected, the scenario should once again be reviewed to ensure that necessary stimuli have been included. if, for example, a C2 goal of close coordination with joint forces has been set, the scenario should ensure multiple opportunities for that type of coordination to occur.

Examine Feasibility

The ACCES measures and data categories should be reviewed to ensure that the task of producing appropriate scores is feasible. Each measure or category involves a specific effort to collect data, analyze it, and report the results. Until the ACCES team is sure that all of these efforts are within its capabilities, the list of measures and data categories should be considered tentative.

A key element of an ACCES application is the ability to collect the requisite data. A review of these requirements, while the application is still being defined, will help keep the application within the realm of feasibility. The number of observers desired will be determined by considering the number of command elements to be observed (i.e., command posts [CPs] and functional cells within each CP), the schedule of events (e.g., an eight–hour/day exercise versus a 24–hour/day exercise), and the availability of automatic collection of exercise–generated data. Two real–world concerns may constrain the actual number of observers used: space limitations within individual CPs and the availability of personnel to serve as observers.

While space within individual CPs will unavoidably limit the number of observers that can be assigned, there are several ways to deal with a potential

shortage of available observers, such as selecting fewer command elements to observe or by lengthening the observers' shifts. Experience has shown that 12 hour shifts are the most that observers can work for prolonged periods and still maintain their alertness. Eight hour shifts are less stressful and allow for more rapid data collation, but make interobserver coordination critical. Coordination or mutual support with any parallel data collection efforts may help to reduce the number of observers, as long as the quality of the ACCES data is not diluted. In all cases, the number of observers should be as low as possible to avoid interference with the operations being observed. Planning includes thinking about observer supervision (generally, one supervisor per shift is sufficient) and provision for observer illness (in exercises with less than twenty observers present, supervisors typically act as replacements).

<u>Select Observers</u>

The quality of the ACCES application is directly related to the quality of the observers' performance. Observers should possess the relevant knowledge and experience, and need to be dedicated to the success of the application. It should be pointed out that highly experienced personnel are not always available to support an ACCES application. However, with adequate training, careful assignment, and proper supervision, less experienced personnel will be able to perform as observers.

<u>Observer Roles</u>

Three observer roles are involved in an ACCES application: Supervisor, CP Observer, and Control Observer:

1. Supervisor: The supervisor should have previous experience with ACCES applications and CP operations. The supervisor's responsibilities include: ensuring that observers are conducting themselves properly, making suggestions on how they might do their job more effectively, examining observer notes to determine whether the proper data is being collected in sufficient depth, and providing information to observers on upcoming events. More than one supervisor may be required per shift to ensure that all observers are adequately monitored during the exercise, particularly if large areas or numerous CPs are involved.

2. CP Observer: CP observers are assigned to individual locations with high priority locations receiving the most experienced observers. The majority of the ACCES team will be CP observers.

3. Control: Control observers collect the majority of ground truth data. Although all of these observers need not have ACCES experience, they should have a knowledge of the types of data available at control, of the data needed to support the ACCES application, and of the best way to collect the required data. Often the ACCES analysts are assigned this role. In computerized games, one control observer is usually adequate. However, large-scale board games or exercises involving a separate Red staff, whose intentions and plans must be monitored, call for more.

A more detailed description of typical ACCES observer assignments is shown in Table 1.

Table 1. Description of Typical ACCES Observer Assignments

Normally ACCES staffs seven different types of locations: (a) exercise control, (b) division main (DMAIN) Operations (OPS), (c) DMAIN PLANS, (d) DMAIN Intelligence (G–2), (e) Division Tactical Command (DTAC), (e) Division Rear (DREAR), (f) one or more brigades. At times, observers may also be located at corps, in the fire support element of DMAIN, or in other supporting elements of the DMAIN.

Exercise Control

The primary responsibility of observers in control is to capture the "ground truth" for the exercise. This includes as much written material as possible concerning unit locations, activities, status and strength for the information handling measures. In addition, the control observers must capture Red intent so that Blue side situation assessments captured at other locations can be assessed. Control observers should have a grasp of the flow of the exercise so they can identify significant events and assist other observers (noting periods of confusion, learning the delay from event occurrence to its reporting and perception in different command centers, etc.) The control observers also collect copies of written plans, orders, mission statements, etc. When corps, some brigades or other interesting command centers are not staffed with an ACCES observer, the control observers monitor key events in these locations. Comments by the exercise controllers or umpires about problems the unit is experiencing should be noted and provided to the relevant positional observers. In addition, errors in drafting orders, role overlaps, and contradictory activities should be noted.

Normally the analysts will be used to cover control. One per shift is normally adequate when the exercise is supported by a computer system that can provide periodic unit SITSUMS for both Red and Blue forces. However, if a board game is used and this information has to be tracked manually two per shift (and three if Red forces are observed separately) may be needed.

Analysts acting as control observers are also responsible for the effective use of the ACCES observers and extracting their data in a useful form. For example, they will highlight measures or situations of particular importance before the exercise. They must ensure that the information handling data is taken at the same times in all locations so the information congruence measures can be calculated. The should ensure that a map and overlay with the key terrain features are available during data reduction and should lead the time line discussions, which means they must understand the flow of the exercise from start to finish. During data reduction the control observer(s) provide ground truth for evaluation of situation assessments, predictions and plan quality. In addition, these analysts review the data reduction forms for quality, clarity and completeness.

In order to assess the subjective elements of command and control effectiveness, control observers must also collect enough information to judge the degree of proactiveness of each decision made, which probably requires discussion with the observers who watched the decision making process.

DMAIN: G–3 OPS

Because this command center is responsible for maintaining the big picture, conducting the deep battle and looking out 12–72 hours, the observers in this location are normally busy and will see a wide variety of ACCES information. At the information handling level, they will find status boards and maps designed to keep the G–3 and Commanding General (CG) up to date. G–3 OPS receives a lot of spot reports and often monitors the current battle. Normally, the SITREPS are addressed to G–3 Ops and the Division SITREP to Corps is developed and sent out from there.

Within G–3 Ops the action often centers around the senior person present. When the CG and G–3 are elsewhere, the Battle Captain will take charge. Observers should be alert to "huddles" where two or more people cluster around a map or in a corner to discuss a situation or issue. In addition, the arrival of a

senior person, a change of shift within the G–3 Ops cell, or the arrival of a senior visitor will often result in a brief summary of the situation. When not covered by another observer, the G–3 Ops observer should attend formal briefings to the CG, which normally take place in a command module near G–3 Ops. Meetings with liaison officers (LNOs) and discussions with G–2 (intelligence) representatives also offer good opportunities to capture situation understandings.

Besides information handling measures, the G–3 Ops observers will see a lot of situation assessment activity, particularly during meetings and briefings. Some decision cycles will originate in the G–3 section, but they may continue elsewhere. Capturing who is involved in them, the situation assessments they involve, the courses of action considered and the consequences that are foreseen for each of them are important. The vision into the future (how many hours ahead are they forecasting and planning) is an important issue. G–3 Ops is also one of the places where observers are likely to detect inconsistencies in the C2 system — contradictory orders, different perceptions of the situation and so forth. Times when decisions are made and directives issued (the G–3 normally signs OPLANs and FRAGOs, many warning orders originate here) are also important. Finally, queries and coordination with other command centers (corps, DTAC, brigades, division artillery, etc.) often originate in this location, particularly when the G–3 or CG are present.

DMAIN: Plans

Plans normally looks 24–72 hours out and examines situations where the mission is known but alternative ways are available to achieve it. Clearly the Plans observer is responsible for those parts of the decision cycle that occur in this section, beginning with the situation assessment that drives the process. Observers should strive to understand the motivation or stimulus behind each plan as well as the missions it supports, including the commander's intent. Red situation assessments as well as understandings of the capabilities of own forces, availability of assets or support from other commands (particularly corps) and the impact of terrain and weather are all potentially important.

During the planning process key issues include (a) which staff sections are involved or consulted (including those at other echelons), (b) how many individuals are involved in the planning (at least one from each section involved), (c) what courses of action are considered (not just how many), (d) whether the consequences of each of them is considered, (e) and predictions of the consequences of actions, and (f) what course of action is recommended. Sometimes a briefing is prepared for the CG or Chief of Staff (COS), which may be practiced in the Plans cell or actually given there. Consultations across cells (with G–3 Ops, G–2, etc.) are also valuable sources of insight, as are shift change briefings or discussions. Plans observers should also seek to capture copies of key graphics and planning documents. Be certain the date–time groups are noted on them. The time into the future for which the unit is planning and forecasting enemy actions and own force efforts is also very important.

Plans observers should also be alert to efforts to obtain basic information from other sections, which are queries or coordination actions. Not only what was sought, but also the answer received and the time required to get it.

DMAIN: G–2

The bulk of the material G–2 observers will see is information handling and situation assessment. Obviously there are both organized intelligence documents (INTSUMs, target lists, etc.) and large numbers of enemy spot reports to be captured. The latter may be written (from other intelligence cells, etc.) or verbal (from units on the scene). Situation assessments (generalizations based on facts) are less common, but more important. Those expressed by the G–2, offered during discussions with other staff cells (G–3, fire Support, etc.) or in the presence of the CG or COS are very important. How far into the future the G–2 staff looks is also very important.

Less common, but also important, are decision making, queries, and information congruence issues. Most G–2 decision making deal with plans and orders for intelligence tasking and collection. In some G–2 shops deception plans are developed or discussed. Queries will arise when information appears incomplete, inconsistent, or perhaps incongruous. Both the fact of the response and the time required to get it are important to note. Incongruence occurs when there are differences between the fact base, general understandings or intent of Red between command cells. These are relatively rare, but stress the decision making process severely. Disagreements and requests for clarifications are often quite loud and energetic.

Discussions with other command centers are important sources of data, particularly on understandings and Red intent. Sharing of data with DTAC, G–3 Ops, and brigades are all very important interactions and should be noted. When a written product is sent, the observers should seek to capture a copy.

DTAC

Observers in DTAC will have the richest view of the battle from Blue's perspective and often have the most data at the end of the exercise. This command center fights the current battle (less than 12 hours into the future) except for the deep battle controlled by G–3 Ops. However, it is also involved in the deep battle and will be the scene of considerable decision making. By doctrine the ADC(M) (Assistant Division Commander for Maneuver) will be the senior person in the DTAC, but the CG and COS may well appear there at any time. As in G–3 Ops and G–2, there is always the Battle Captain in the DTAC and significant new information will tend to flow to that person.

The maps in the DTAC are hard to get close to, but they are also among the most important to check for currency, completeness and accuracy. Unit status data are perishable in the current battle and must updated regularly. At the same time, there will be a large number of situation assessments, usually in informal discussions. Similarly, DTAC status boards are important since they can mislead decision makers unless they are managed well.

Many of the issues that arise in the DTAC are settle there, creating small decision cycles within the larger division plan and decision cycle. This will include problems involving a single brigade, task organization issues, creation or commitment of a reserve force, etc. In an effective division, many of these will be activations of contingencies. Key decision information (stimulus, participants, courses of action, predictions, decision–directive consistency, decision time, etc.) should be captured as well as the warning order and directive preparation time when the cycle stays in the DTAC. Copies of directives and transcripts of verbal orders should be captured. The time into the future the DTAC looks when projecting its own actions and those of the enemy is an important issue.

DTAC receives a large number of spot reports from the current battle and seeks a good bit of information, both so it can keep its information base current (queries about unit capabilities and progress of the battle) and so it can manage the current battle (coordination actions to ensure assets are available, units move in a timely fashion, etc. Understanding (situation assessments) usually emerge in discussions of issues. Courses of action are often discussed informally and rapid decisions where only a single course of action is considered are not uncommon.

DREAR

Normally the Assistant Division Commander for Support (ADC[S]) will run this command post. In a few units it will still be referred to by its older name, the Rear Area Operation Center (RAOC). The DISCOM commander and G–4 are also likely to be present and one of then will run the center in the absence of the ADC(S).

Observers in DREAR will see and hear less about the current battle and more about the future plans that the division support structure will have to support. There will be queries from the DMAIN and DTAC about the availability of assets and responses to these should be tracked closely. Unit losses (personnel and equipment) as well as requests for specialized assets normally kept in the rear (the bridging equipment, chemical munitions, etc.) will operate as stimuli for decision making. This will involve (a) finding assets (within the division reserves, by cannibalizing line items within the division, from adjacent units, corps or echelons above corps) (b) figuring out how to acquire or task them, or (c) movement plans to get them where they are needed. Solving maintenance problems for key systems may also force decisions. These will be genuine decision cycles, but they will deal with DREARs problems within the context of the larger division and corps plans.

The DREAR will have a great deal of interaction with the corps headquarters and will both make queries to them and respond to their inquires. Perceptions of the situation, particularly about the status of Blue units, will be expressed and may be out of date because distribution of reports is slow or incomplete. In addition, the DREAR should have the longest view into the future since it must foresee Blue needs well in advance.

This organization is supposed to be able to take over the battle if the DMAIN and DTAC are knocked out simultaneously. As a result, the DREAR should be monitoring the current and deep battles, Red capabilities and intent as well as the CG's intent and concept of operations. Congruence of information and situation assessment between DREAR and other command centers is often a problem area, so collection of perceived situation information is important. In may cases, the processes of decision making in DREAR will have very finite timing parameters so that roads or air assets will be used efficiently, which means quite specific forecasts are made of future situations.

Brigades

Maneuver brigade observers have very similar responsibilities to those in DTAC. The whole battle (intelligence, operations, and support) funnels through their command center, except that the scale is smaller than the division front. Hence note the requirements for that post, including perceptions of Red intent and the vision of the unit into future times. The pace is rapid and many of the decision cycles are brief and focused on specific battlefield situations. Brigades send and receive large numbers of spot reports as well as regular SITREPs and INTSUMS. They also process a large volume of coordination actions and queries.

The largest volume of information flow within a brigade comes from its subordinates (which ACCES does not normally cover), followed by DTAC and DMAIN. Most of this is information handling, but the situation assessments expressed are very important. Very often problems develop with information flow from adjacent units or with units that are supporting or coordinating their actions with the brigade. Observers should be alert to inconsistent perceptions and directives, which usually result in vigorous discussions with other command centers. In addition, shift change briefings are very important within brigades.

The CG will often visit brigade command centers, in which case a briefing of the situation is normally in order. This may lead to a discussion of alternative courses of action or a decision cycle to resolve problems. Similarly, LNOs and senior officers who have visited the division command centers may come back and brief what they have learned.

Finally, brigade observers should pay close attention to directives issued or received by the unit including the times they are sent and received. Decision–directive consistency, clarity (absence of queries) and the time needed to prepare directives are all normally available to the alert observer.

When an aviation brigade is covered, the ACCES observer will need to ensure that key status boards such as crew rest, aircraft availability, and POL (petroleum, lubricants and oil) availability are tracked.

In addition aviation brigades must look further into the future than ground maneuver brigades because of their greater need for logistic support during combat.

Other Observation Positions

During specialized applications, observers may be put in other locations. Probably the most common alternative is to place an observer in the corps command post so the division's activities and reports can be seen through a different perspective. This is a simple case since the corps command center structure generally follows that of the division. Hence, observers assigned to Corps G–2 can use the general guidance for a DMAIN G–2 observer, a Corps Ops position the DMAIN G–3 Ops guidance, etc.

Most of the lower level cells are specialized elements of a division command center, such as the Fire Support Element or Chemical Warfare Section. Observers in these locations should (a) determine what information handling tasks are conducted (for example, chemical warfare units plot the time and location of strikes, rely on spot reports and specialized warning reports, create warning messages and alerts), (b) what situation assessments are routinely handled (for example, the fire support element may assess the artillery threat in various sectors) and (c) what decision cycles occur here.

At the same time, general information that shows how well this element is plugged into the division overall are also very important. Hence, the age, completeness and accuracy of all maps and status boards should be assessed. Similarly the times and contents of status reports, directives received or issued, queries and query responses, as well as coordination activities should be recorded. Capturing situation assessments will also allow the ACCES team to track the consistency of information throughout the C2 system.

Identification of Observers

Observers may come from a variety of backgrounds. Those used successfully in past applications have been:

1. active duty or Reserve officers;
2. Department of the Army civilians;
3. contractor personnel with Army–related experience;
4. retired military personnel with C2 experience,; and,
5. personnel experienced in related applications (e.g., HEAT or prior ACCES).

Usually a mix of these types of personnel participate as ACCES observers.

Assignment of Observers

Observers should be assigned and "acclimated" to their observer position as soon as possible. It is wise to identify one or more alternate observers in case unforeseen problems arise with the primary observers. In making individual assignments, the ACCES team chief should consider: previous ACCES–related experience, experience with CP procedures and Army doctrine, and the sensitivity of the location. The following guidelines are provided:

1. Supervisors and observers at key locations (i.e., DTAC and the senior observer at Control) should have previous ACCES–related experience and a thorough understanding of ACCES theory and practice.

2. Observers at DMAIN, DREAR and primary (rather than reserve) brigades should have previous ACCES–related experience. Due to the more tactical nature of the play at the brigades, observers at these locations should have previous military experience in CPs.

3. Remaining positions may be filled with personnel new to an ACCES application. Observers at the brigade level should have previous military experience in CPs.

Tentative assignments of observers can be made during the planning for an application. However, final assignments should not be made until the completion of observer training. Individual preferences for location and shift (e.g., 1st brigade or 2nd brigade, day or night) should be considered within the general guidelines. However, experience has shown that observers with close working relationships (friends, work-mates, etc.) should not be on the same shift at one location. Rather they are best assigned to the same location on different shifts, where their established working relationship makes communication better.

Establish Data Collection Plan

A well thought–out Data Collection Plan is the key to a smooth and successful application. Figure 2 shows a sample format for the plan. This plan should be an evolving document that provides for tracking of new work and changes to old work. It

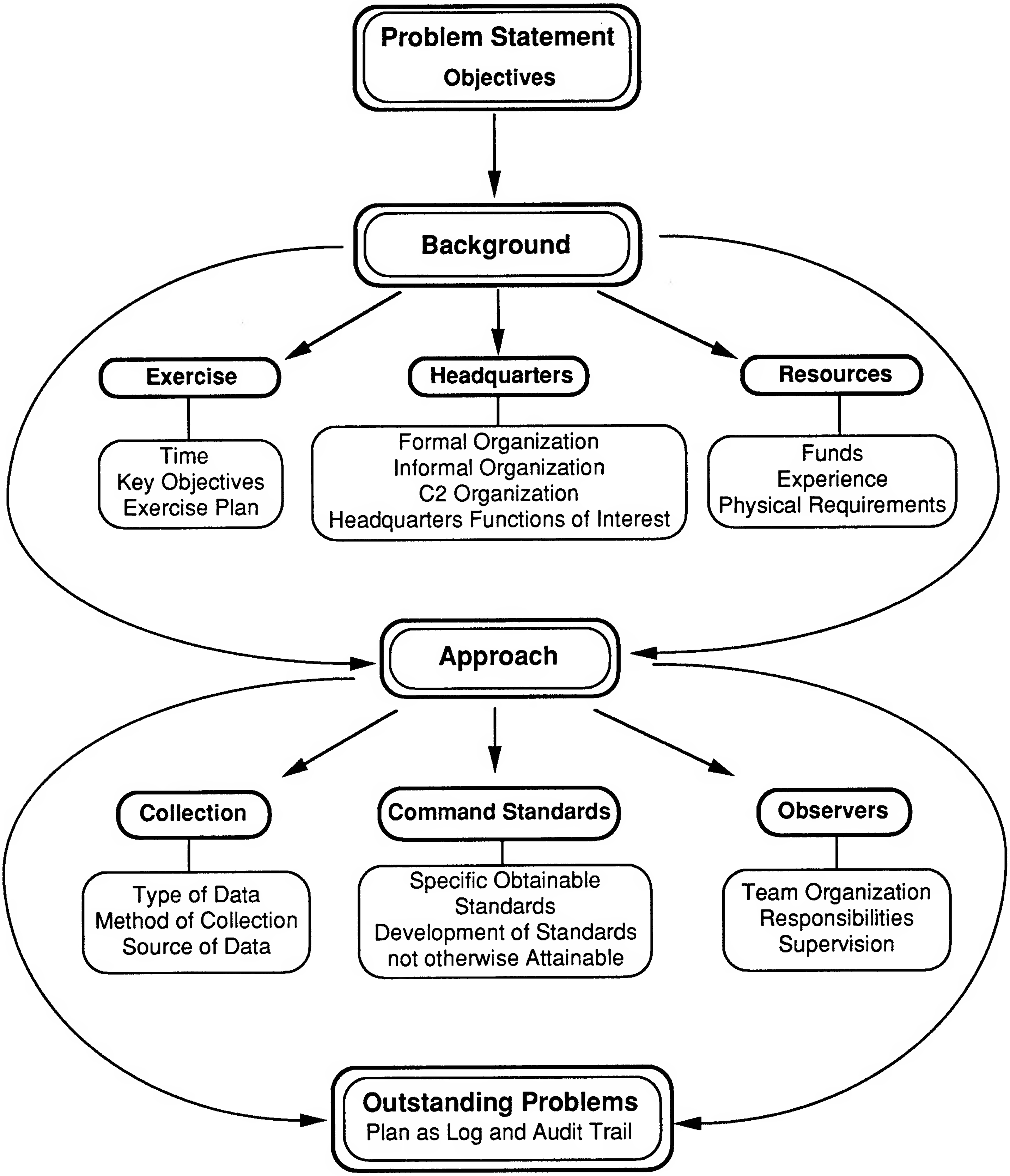


Figure 2. Sample Data Collection Plan

will ensure that all participants know what is going on, and will uncover problem areas and required action items before they become critical. The following paragraphs explain in more detail the components of the Data Collection Plan.

Problem Statement

The problem statement should reflect the objectives for the ACCES application. It should be simple and concise. The objectives may change as planning for the application proceeds; these changes should be reflected in the Data Collection Plan

Background

The plan should include background information related to the headquarters to be observed, the exercise itself, and the resources required for collection. Include both the formal (diagramed) organization and the informal organization (the way it really works). The C2 organization should be described as well as the headquarters functions of interest to the application. An ACCES briefing should be set up with the headquarters and individual commands to be observed to familiarize them with ACCES and what the application hopes to accomplish.

In describing the exercise itself, use the plan to log the important aspects: when it will take place, what the key objectives are, and what the exercise plan says.

Resources are an important, but often overlooked factor. Lack of sufficient travel money to get all observers to the exercise is a problem that should be raised and resolved. If the observers' experience is in units different from those being observed, this needs to be addressed. If all the observers have been desk–bound for years and the exercise demands extensive walking, this too should be brought to their attention.

Approach

The approach has three sections: collection, observers, and command standards. In general, the approach should address how each of these areas will be tackled and provide a schedule of plan for the performance of required tasks.

Collection.

What kind of data will be collected, how they will be collected, and where they are coming from are important topics. Procedures need to be established for collection of exercise–generated data for each CP observed. Specifically, what types of data can be collected automatically (e.g., messages, overlays, and orders) and when should they be collected (e.g., every six hours, end of exercise, etc.).

Observers.

Observer organization into teams, allocation of responsibilities, and supervision to ensure that the data collected meets ACCES standards need to be addressed. It may be that these decisions cannot be made early, but they should be tracked.

Command Standards.

The ACCES measures which require command standards need to be identified early so that the standards can be obtained. If unobtainable, or the command has no standards that match the measures, command standards have to be developed by the ACCES team and approved by the command.

Outstanding Problems

Tracking problems as they arise and are ultimately resolved is an essential element of the data collection plan. Neglected problems can develop into huge catastrophes. This section allows one to keep track of problems requiring resolution (so that they can be moved to background or approach). Use the plan to provide an audit trail. The plan may also be used both as a log. It is a place to keep track of decisions, events, and the time needed to solve the problems encountered. This log will be a good reference as preparation for the application advances. If kept up–to–date, the log also can provide lessons learned after the fact and prevent some "Murphys" in the future.

Preparing for the Exercise

The ACCES team should send an advance party to the exercise site up to three days prior to the state of observer training. This will facilitate in ensuring that a proper classroom is set-up, use of videos, projection screens, tables and chairs. Also this team will also get the local exercise data and arrange to have a member of the unit come into training and give a description of what will happen in the exercise. Get CP locations and local rules on rental cars in training areas, etc.

Security Arrangements

Prior to the exercise, the ACCES Application manager must make a variety of security arrangements. First, the need for clearances and secure storage must be established. Second, the currentness of all observers', analysts', and supervisors' clearances must be established. Third, those clearances must be conveyed to the exercise organizers. At the same time, arrangements must be made for a secure training area, for secure on-site storage of classified observer notes and exercise materials, for secure data reduction, and for secure transfer of the exercise data back to the analysis site. These arrangements must be made, verified , and followed up in detail, since errors in this arena can cripple the application and are, of course, unacceptable.

Physical Arrangements

Moving a group of people to an exercise site, supporting them there, and bringing them back with their data requires a host of physical arrangements. First, the equipment needed for the exercise must be identified and acquired. This includes observer forms, reliability forms, clocks, clipboards, pens, and so forth. Second, ACCES team members must be informed about on-site weather conditions, appropriate clothing, emergency points of contact, etc. Travel, motel, and rental car

arrangements must be made, including provision for the unusual hours and shift changes required. Training facilities and equipment, including television and VCR equipment, maps, overlays, blackboards, easels, etc. The equipment for data reduction, including local arrangements for reproduction, must be organized.

Reliability Data

ACCES has a number of documents which are used to test the reliability of observers and to compile statistical data on observers over time. These documents, beginning with those relating to observers, need to be given out at the appropriate times throughout the training and post-training so as to ensure that all reliability data is collected and graded by the senior team members. They also provide an indication of which observers, if any, are experiencing difficulty during training and may need additional help.

Train Observers

Observation of an exercise typically requires more personnel than any other phase of the application. Generally, some exercise observers will not be permanent members of the ACCES team, and thus must be trained in the skills needed to support the application. Also during this time, ACCES evaluation data must be collected to ensure the reliability of the ACCES product. The observer questionnaires should be completed prior to the start of training, all tests and quizzes should be completed during training, and finally, the observer's comments both on the training and on the exercise itself must be captured. Observer training covers several points:

1. objectives of the application, so that the observers understand the reasons for the current effort;

2. basic concepts of ACCES, including the headquarters control cycle, so that the observers understand how ACCES addresses the activities that they will be observing;

3. activities to be observed , so that the observers know what they can expect to see;

4. categories of data to support the ACCES measures, so that the observers can identify required data when they observe them;

5. guidelines for the observers' conduct, in order to maximize the useful data collected and minimize disruption of the activity; and

6. recording techniques during the exercise and the transfer of the information collected to data sheets, so as to facilitate understanding of the types of data needed.

Two days (16 hours) of observer training are normally held immediately prior to the exercise. At least one day is left open after the training program to permit observers to visit the CPs they will be observing: to make sure they can find their way; to meet the personnel who will man the CP; and to become familiar with the maps, status

boards, etc. from which they will need to get information. Instructors also may use some of this time for additional training for all or some of the observers as necessary.

All observers (supervisors, CP observers, Control observers) should attend the entire training session, even if they have participated in previous ACCES applications. This serves not only to refresh their memory on ACCES applications, but also makes them aware of any differences in the ACCES measures to be collected and informs them about the application to be observed. Additionally, experienced observers can make valuable contributions to the training effort by providing examples taken from their experience. This interaction also helps to create a team atmosphere among all participants.

The proposed observer program of instruction is included in Appendix A; Table 2 provides a summary outline of the training program.

Additional logistical questions need to be addressed during training. Specific assignments for location and shifts need to be made, preferably near the end of the second day. Arrangements for transportation of observers need to be made (as well as ensuring that the observers know the location of the commands to which they are assigned). Instructions on command rules concerning dress, security, restricted areas, food consumption, etc. need to be passed on to observers. The schedule and location of the data reduction effort should be made final and relayed to the observers. Team meetings should be scheduled during the exercise in which to discuss events of the exercise, as well as problems encountered if at all possible. All observers need to know the times and locations of these meetings before they leave training.

Table 2. Outline of Training Program

Title	Scope
Introduction to ACCES (1 hour)	Introduce methodology and observer's role in evaluation.
Data Collection (1 hour)	Requirements of data collection, general relationships of data categories, measures to be supported, observed/ exercise generated data, required skills.
Data Reduction (1 hour)	Data reduction process and data sheets.
Exercise Orientation (2 hours)	Division organization to be observed and general objectives of the exercise.
Observer Techniques (1 hour)	Characteristics of an ideal observer.
Observer Requirements (1 hour)	Support requirements embedded in data collection effort.
Data Collection Demonstration (1 hour)	Desirable and correct data collection techniques.
Data Collection Practical Exercise (1 hour)	Prepared brief and exercise action presented for observer data collection practice, followed by discussion.
Data Reduction Demonstration (1 hour)	Sequence of events involved in data reduction and properly completed.
Data Reduction Practical Exercise (2 hours)	Observers reduce briefing notes and journals collected in earlier practical exercise to data sheets.
Exercise Briefing	Objectives, scenario, significant events, areas of interest, and control mechanism for exercise presented by officer conducting exercise.
Review Discussion (2 hours)	Essential observer knowledge of the control cycle, measures, and relationship of measures, data categories, relevance to data sheets and observer collection.

Data Collection and Reduction

The duties of an ACCES observer are to record C2-related activities that are not otherwise documented (particularly decisions, situation tracking, course of actions) and to ensure that all necessary documentary data is collected. Correct observation is critical to a successful and complete evaluation. The observer must be constantly aware of the actions of and communications between the commander and staff members. A great deal of activity occurs in the CP during an exercise; the observer must concentrate on those activities actually relating to C2. The observer must record verifiable facts to support the subsequent calculation of C2 evaluation scores and refrain from injecting any professional judgment on the quality of the operations during the data collection. Before leaving the site, observers are also responsible for converting their raw materials (journal notes, copies of messages, plans, overlays, and other materials, etc.) into completed ACCES data reduction forms. Analysts and the ACCES application manager act as reviewers, integrators, and quality control agents during this effort. Finally, the host unit is briefed and thanked for their cooperation.

Observation Techniques

It is difficult to describe the process of effective ACCES observation in the abstract. The next few pages try to do that in a way that communicates both the importance of the task and the lessons that have been learned over the past several years during thousands of hours of experience by dozens of different collectors. Two different but overlapping discussions are provided. The first describes the characteristics of an ideal observer and explains very briefly why each is important and what they mean in practice. The second discussion approaches the observation process as a dynamic sequence of events beginning with pre-exercise activities then dealing with typical observation days in terms of (a) before exercise play begins, (b) during exercise play, and (c) after the exercise systems is ended. The two discussions are intended to complement one another and provide new observers with insight into the art and the science of collecting high quality data during an exercise.

The Characteristics of an Ideal Observer

An excellent observer can be recognized immediately by those in supervisory roles and those on the staff of the evaluated organization. Briefly stated, he or she is:

1. prepared
2. persistent
3. polite
4. alert
5. unobtrusive
6. efficient
7. security conscious
8. professional
9. consistent
10. a team member
11. positive, and
12. an observer, not an evaluator.

Success on all of these dimensions is a challenging task, but has proven possible for the wide range of people who have been observers in the past. Table 3 explains each in some detail.

Table 3. Characteristics of an Ideal Observer

Prepared.

It is not possible to walk into a CP ignorant and begin taking high quality data. The observer must take the time and make the arrangements to understand the crucial aspects of the collection. It is not unusual for some observers to be more aware of key aspects of an exercise than many of the participants. Among the things it is possible to understand and which the observers need to master in advance are:

1. order of battle, both for Blue and Red;

2. exercise objectives and points of emphasis from training;

3. the flow of exercise events;

4. the existing plan and significant message traffic;

5. the topography of the exercise area;

6. the organization of the Blue forces and its relationship with other commands;

7. physical layout of the CP;

8. routine schedules, briefings, enemy intelligence summaries (INTSUMS), commander's situation report (SITREP), shift change-over; and,

9. the basic fundamentals of ACCES.

Any of these factors not understood by observers will take them time to learn during the exercise and distract them from the main task of gathering ACCES data.

In addition, being prepared includes the simple procedural responsibilities essential to maintaining continuous presence. Having supplies (collection forms, clipboards, writing instruments, watch, etc.) is obvious, but essential. If breaks are expected and only one observer is on site, having some type of snack food available becomes important during a 12 hour shift. Ensuring unobtrusive access to a message file and automatic collection beforehand frees up the observer during exercise play.

Persistent.

The quality of data obtained is directly related to the observers' efforts to collect it fully. Experienced observers establish their need for access early and ensure that the command is fully aware of it. During the exercise, they assume they are welcome to listen in on any relevant conversation. By asserting their access early, they accustom the staff to their presence and keep the question from arising later. At times this means accompanying a senior officer or general officer to meetings.

During briefings and decision discussions, the observers must position themselves where they can hear. This may require team-work on large staffs. In addition, the principle of persistence requires that the observers not become distracted but focus on the key perceptions and ideas that are voiced during decision making. Reading over the Ops Officer's shoulder or listening as an Intel Officer explains a new unit at the map require a determination to know what is happening. The continuous presence of observers is one of the unique characteristics and provides a basis for many of ACCES's most useful measures. Often the only person in a CP who knows the full sequence of events is the ACCES observer.

Polite.

Observers are guests in the CP and should behave as though they understand this. The purpose of the exercise is usually training, with ACCES being one form of feedback on its effectiveness. Observers should be ready, if required, to explain what they are doing and why, and to provide reference to messages and briefings to the ACCES point of contact. Thanks are due to the commander and those of his staff who supported the observers and should be provided at appropriate opportunities and at the end of the exercise.

Alert.

CPs are busy places. By being familiar with the physical layout and work processes of the staff under study, observers can learn to detect the presence of new information or new action-items. Early in the exercise, observers learn the names and faces of key participants so they can follow events more easily and make notes that trace the flow of information on an action. It is not uncommon for an observer's journal to note radio calls unanswered, new items received in the CP, the failure to update maps and status boards, or other simple errors.

Unobtrusive.

Observers must find ways of blending into the background. Their personal belongings (coats, bags, etc.) need to be stored out of the way; usually the unit will tell you where to store things. Observers must find places to stand that do not interfere with the work flow or block the view of status boards, maps, or other decision aids. Observers do not interfere with the flow of the exercise, either by providing warning to upcoming events or feedback on performance. Observers may inquire, at a time and place that does not intrude on the exercise, why a command took a particular action, but they may not ask why an action was not taken. Asking why something was not done is tantamount to suggesting a new course of action, which is interference. Questions are never asked when the CP is busy; this would intrude on the exercise.

Efficient.

The amount of activity in a CP can be enormous; observers who are not efficient will be overwhelmed. Being prepared, meeting the players, and knowing their roles will help. However, there are several simple procedures that will also save time.

Note-taking can be greatly speeded by the use of acronyms or initials, either using usual military acronyms, or providing notes on the meaning for later interpretation. Written messages can be referred to by date-time-group (061330 Sep 91), which will allow identification during the analysis phase. Many experienced observers also annotate their journals to identify key items (decisions=D, tracking the situation=T) and put in procedural errors (unanswered radio call from____). This saves time later in generating data sheets.

Security Conscious.

Having established appropriate need-to-know prior to the exercise, observers must remember that they are outsiders and therefore a potential source of security problems. Awareness in this area is high. Badges will be issued by proper authority to gain entrance to CPs and exercise activities. By establishing the procedures for storage, marking, and transfer, later problems can be avoided. Visible security awareness is an essential attribute of effective collection. Know and follow the rules set by the unit conducting the exercise.

Professional.

The Army is made up of professionals. Their respect can be earned only by professional

behavior. The long hours both groups must work together in an exercise is one form this takes; being prepared is another; and maintaining a posture of interest and learning is another. Little things like being on time, delivering on small requests (arranging for an ACCES briefing), and answering questions even when it requires you to go out of your way, go a long way in this arena. Do not express your opinions or render judgments on topics beyond your personal experience. Defer requests for feedback on the exercise until after the analysis, since you are only seeing one small part of the overall exercise.

Consistent.

The continuous presence of observers allows collection of compatible data over time and across situations. This opportunity is wasted unless each observer makes notes on the events at hand and takes the time, both during the exercise and while completing data sheets, to ensure consistency of scoring. Seeking help from senior evaluation team members and comparing notes with other observers can help here.

A Team Member.

The collection of data is a team effort. In the Division Main CP, people can and must cover for one another when heavy activity occurs in one arena while other are less active. At brigade level, or in a TAC CP, this is not possible, but other observers should be alert to noting items from other CPs that may prove valuable to the overall collection effort. For example, a directive that causes confusion, consternation, or delay may look perfectly clear at the CP that issued it, unless queries or objections are recorded at the receiving locations. All observers should be alert to the importance of information and perception comparability. During the data reduction and analysis phases, the team role of ACCES observers becomes obvious to all concerned. Good observers find their notes make more sense when discussed with those from other locations involved in the same C2 activities. Unless notes have been kept with that in mind, however, the reconstruction of important control cycles becomes difficult and time consuming.

Positive.

The tone conveyed by an observer is positive and helpful. Success is expected both from the exercise and the collective perspective. Notes are taken in positive terms (e.g., 0730: friendly unit status boards last updated at 0530, not 0730: Friendly status boards not yet updated). Notes are made when possible solutions to problems are observed. Whenever possible, reports and feedback should be complimentary. Even a unit that experiences considerable C2 problems can be credited with learning over time and benefitting from the exercise. Credit should be given to staffs that solve their own problems, improve procedures during the exercise, and/or exhibit obvious learning. Here, again the creation of excellent working relationships and effective performance will be helpful.

An Observer Not an Evaluator.

ACCES is designed to answer difficult questions about the processes and effectiveness of complex decision processes. Observation is the initial process of capturing information. After data reduction, analysis, and review; this information is capable of answering questions and generating insights of value to the Army professionals. ACCES is not an evaluation system, nor are observers necessarily qualified to evaluate the staffs they see. Certainly they cannot do so based on the unprocessed information or in the absence of the data being collected elsewhere during the exercise. Observers are aware of the limits of their information while on site and behave accordingly. Defer comments on performance until after analysis is completed.

1. Refer requests for information to senior ACCES team members.
2. Do not tell the staff or commander how you would prefer to see things done or how you would operate.
3. Do not discuss exercise performance or problems where the participants can hear you.

The Dynamics of Collection

Those inexperienced in the collection of ACCES data are most likely to be concerned about the very busy exercise phases during which the pace of events may overwhelm the collection process. Experienced observers know that he key to effective collection during these chaotic periods is what has gone on before them and what will follow afterwards. This does not make the intense periods of the exercise easy to observe, but it does make it possible to observe them. The discussion that follows proceeds from pre-exercise to post-exercise activities and traces typical activities during an exercise.

Pre-exercise Activities

Developing the knowledge base described earlier under the topic of being prepared is one major focus of pre-exercise activity. Attending observer training and reading both the plans developed by the commands and their key messages are essential when the observers arrive. The ACCES application manager must also ensure the support structure exists to allow effective collection: a secure area for ACCES training and data reduction, clearances in place, message traffic being set aside, and a thorough briefing on the unit, exercise purposes, order of battle, and exercise structure. A visit to the CPs must be scheduled both to identify key physical locations and to view displays.

Exercises often involve a period of up to one day during which communications are established, databases loaded, and the enemy situation develops. During these periods, CP activity is minimal. These lulls provide an opportunity for observers to introduce themselves to the individuals on the staff and to experiment with different positions in the CP as observations posts.

Typical Exercise Day

Almost all Command Post Exercises (CPX) and Field Training Exercises (FTX) are continuous; they run 24 hours a day for from five to seven days. To support these exercises the ACCES observers will normally work in 12 hour shifts. At times, ACCES supports an 8 hour shift, but that is unusual. ACCES shift changes never occur at the same time as those in the exercise unit. This allows observation of the quality and effectiveness of the unit's shift change procedures.

Observers should plan to be in position at least 30 minutes before scheduled staff shift changes. This will ensure adequate time for observers on the previous shift to brief the next shift of observers before the staff shift changes. The image of professional, consistent, and persistent collection is enhanced when the ACCES team pulls the same long hours as the staff. Moreover, this usually ensures that ACCES team is prepared for briefings, and the identification of mission information, plan problems, and other items important to observation.

Checking status boards before the shift begins enable notation based on exception for later changes. Often staff-shift change-over briefings provide insights into current perceptions, and allow later note-taking to be brief and focus on changes.

The distribution of collection activity is far from even during shifts. Periods of high activity include preparations for briefings, the outbreak of hostilities, military actions by Red, and offensive activities initiated by Blue. By and large these can be predicted, based on knowledge of the exercise scenario and attention to Blue decisions and directives. Observers need to use all of the relatively low activity periods to develop detailed notes on situation, decisions, predictions and directives so shorthand notes will be adequate during the busy periods.

Observers need to remember that the goal is to record the situations and perceptions that drive decisions. Hence, they should always try to be near the senior officer in the CP. Observers may also have to accompany staff officers who leave the CP to brief commanders and decision makers. Second priority goes to knowing when new information or ideas come in; therefore awareness of traffic from the intelligence section, radio traffic, and hard copy distribution is important. Every time a situation is explained, an observation opportunity occurs. Updates to senior officers who visit the CP, explanations of the current situation to visiting general officers, shift change briefings, and talks with liaison officers are opportunities to collect data.

Note-taking should be a consistent updating of information which can be recorded perfunctorily. Noting date-time-groups from messages relieves the need to copy the contents. The use of abbreviations and initials for people and positions saves time as does nicknaming plans. However, observers should keep a list of the initials and nicknames used in their notes, so as not to lose those data. Sketching can also provide a valuable method of preserving information. Notes need to be made in a form that will facilitate analysis. The exact times that the exercise is halted and/or restarted must be written down.

Finally, notes should be taken on follow-ups that are needed. If, for example an order comes into your CP from higher-up, and the observer does not understand the rationale, a margin note should be made to follow up with the observer at the higher CP. Similarly, if a coordination is attempted but no response is observed, the observer at the other CP may know what has happened to the request.

As each shift draws to a close, the observers should prepare notes to brief their replacements and ACCES team leaders. These notes should include key decisions during the shift, open actions, pending decisions, and decision cycles started but not yet completed. A review of your notes may also reveal questions requiring follow-up to be discussed with other observers.

<u>End of Exercise</u>

As the exercise ends, the observer must ensure the integrity of the data. This means assembly of notes and data, message traffic, logs, and other materials. Whenever possible these are hand carried by the observer to ensure their availability during data reduction and then returned to the unit. If security requires other arrangements, the observer ensures that the data is not lost, or stored where it cannot be used.

Departure from the CP should be handled professionally. When possible, direct thanks are accorded to the commander. In any case, those who have hosted or supported the ACCES observer should be thanked directly for their assistance. Every observer should understand the importance of this professional courtesy.

Data Reduction

Data reduction takes place immediately following the exercise with all observers gathered at one location. The planning factor for estimating the time required to conduct the data reduction procedure is that one hour of data reduction will be required for every 2 1/2 hours of observation (e.g., one observer collecting in four 12–hour shifts would require 19 hours of data reduction effort). This planning factor is based on those cells that usually produce the greatest volume of data (Current Ops, DTAC). Through the data reduction process, observers' notes, observers' memories, and exercise–generated data are used to produce completed data sheets. The process requires the observers to reduce their notes to data sheets as soon as possible after the exercise for a variety of reasons: the observers' notes are not a smooth record and are usually intelligible only to the observer who made them; and observers' notes are, at best, seldom a complete record of CP activity, and need to be supplemented by observer memory, interaction with other observers, and exercise records. Reducing the data as soon as possible after the exercise increases the probability of capturing data from the observer's memory before it fades.

The overall process of reducing observer notes to data forms is explained in detail below; samples of each data form are included as Appendix C.

Overall Data Reduction Process

The steps used to complete data sheets are listed in Table 4. Although these steps do not need to be followed exactly to reduce collected data to data sheets, experience with numerous exercises has shown that more complete data sheets can be produced, with less time and confusion, by using the sequence shown.

Table 4. Steps to Complete Data Sheets

Step	Action
Time Line Construction (led by senior control observer)	Group discussion to define key events and control cycles.
Exercise Control (often completed before the exercise)	xE forms completed by senior supervisor. (N.B.: All subsequent forms are filled out by each individual CP team, coordinating with other teams as necessary.)
Predict Courses of Action (COAs)	PC form filled out for each set of COAs analyzed.
Decision Control	DC form completed for each decision.
General Plan Data	G form completed for each decision implemented as a plan.
Information Congruence	IC form completed for each coordination leading to an action.
Tracking the Decisions	One or more T forms filled out for each prediction or understanding related to a decision.
Preparation of Directives	PD form completed for each decision implemented as a directive.
Tracking Other Understandings	T and PC forms completed for understandings and predictions not connected to decisions.
Data Monitoring	IH forms completed for all reports and queries.
Review of Completed Forms	Data reduction forms, logs, and exercise-generated data reviewed to ensure all relevant data have been coded. Forms checked for legibility and completeness.
Analyst Scoring	Forms turned over to analyst, checked for clarity, continuity. Resolution of inconsistencies, discontinuities, clarifications coordinated with observers. "Analyst only" form sections are scored.

Prior to data reduction the ACCES application manager should ensure the necessary supplies and materials are all present. This means forms for recording data, all observer journals, copies of planning documents (OPORDS, OPLANS, FRAGOS, etc.), message traffic, maps, overlays, computer printouts, and other exercise documents. The control observers and the ACCES manager should have digested the exercise play and identified key events they want observers to examine. At the beginning of data reduction, observers participate in a group discussion in which the overall events of the exercise are put in a time line identifying the control or decision cycles. This initial interaction brings everyone into focus with key exercise events that might not have been seen at all locations. The data sheets are then completed for each headquarters by the observers grouped according to the CPs they observed.

One set of Exercise Control (xE) forms should be filled out by the senior supervisor. Often this is done before the end of the exercise. One Predict Courses of Action (PC) form is completed for each prediction expressed. One Decision Control (DC) form is completed for each decision, whether it is a new plan, activation of a contingency, or a minor adjustment to an existing plan. Any decision implemented as a plan should have a General (G) form filled out for it. This data sheet captures the data needed to compute the overall planning scores and the diagnostic scores for issuing directives and adjustments to plans. At the functional cell level (e.g., Intel), an Information Congruence (IC) form is filled out for each coordination of information between cells leading to or in support of an action or decision. If the information was an input to a Division decision cycle, this fact should be noted.

For each PC, DC, G, or IC form completed, one or more Tracking the Situation (T) forms can be completed. In the case of decisions implemented as plan directives at the Division level, a Preparation of Directive (PD) form can also be completed. Form T captures the data needed to compute enemy and friendly situations. A separate data sheet is completed for each expressed understanding. After all the understandings and predictions related to decisions are recorded, the understandings and predictions expressed by the command, but not connected to decisions, are documented on additional PC and T forms.

The data monitoring forms are filled out next. The Information Handling (IH) forms are used to record data needed to compute the timeliness, accuracy, completeness, and clarity scores for monitoring and reporting of friendly and enemy units. Entries should be listed chronologically; more than one message should not be scored on the same data sheet.

After all data sheets are completed, they should be reviewed to make sure no information is missed from the observer notes or exercise–generated data. It is important that all parts of the data sheet are filled in completely and legibly. The set of data sheets then is presented to the analyst for scoring. The analyst, in turn, must ensure that the sheets he eventually receives from each organization include all the data sheet formats, cover all periods of the exercise, and have no missing entries. After any questions the analyst has are answered and all the gaps are filled, the members of the observer group are encouraged to make a record of problems or anomalies based on their observations during the exercise. These insights are

presented in written form to the analyst and discussed as appropriate. The application manager is responsible for securing the data and making certain it is properly transferred or shipped to the analysis site.

Brief Unit on Insights

The application manager should also arrange for an exit briefing with the unit. Normally this is offered to the commander, but it may be with a senior staff officer (the chief of staff, G-3, etc.) who has worked with the ACCES team. This briefing should include three kinds of material:

1. courtesy items (thanks for help and support, specific kudos to individuals on the staff who were particularly helpful, positive comments about the exercise, the scenario, and the unit);

2. suggestions and recommendations for improved C2, particularly procedural or formatting comments, derived from experienced ACCES observers' insights on how the unit might better perform C2 (displays, procedures, communications gaps, and similar items are often mentioned); and,

3. insights (not hard findings) derived from observation, development of the time line, and the data reduction process,focused as much as possible on the exercise objectives and supported by specific examples.

As part of the briefing, the ACCES application manager should also ensure that the unit knows that these materials are offered as a constructive criticism and are not hard ACCES findings. Arrangements should be made for delivery of the final report and briefing on the findings after analysis is complete.

Analysis, Final Report, and Archiving of Data

Data Analysis

As soon as the analysts arrive at their home station, they should review the data reduction forms and other materials shipped, to ensure that their working files are complete and no security breach has occurred.

Analysis is described in separate training materials. However, the basic work process is parallel to that done by observers. First, the analyst team meets to review the exercise. Next, the team attempts to identify all the ACCES or decision cycles and to score them. Following that, each C2 function is scored. Analysts must exercise judgement in regard to the data forms they review, fixing those with obvious errors or problems that can be resolved from other documents, but eliminating any suspect items. The data used should be unambiguously valid.

Most of the analysis effort is aggregation, moving from individual score sheets to summary statistics (means, medians, ranges, percentages, etc.) For some variables, such as proactivity, they must make a variety of inferences.

Final Briefing

The application briefing is prepared in conjunction with the application report and should contain sufficient information and supporting data to provide a clear understanding of C2 performance. The purpose of the briefing is threefold:

1. provide analytical feedback to participating commands and elements while the exercise remains fresh in their minds;

2. provide a forum for questions and answers to ensure a better understanding of the insights, conclusions, and trends being reported; and,

3. draw attention to exercise areas considered important that may be quantifiable upon further analysis.

Normally the analysts will create the briefing viewgraphs first around overall C2 effectiveness, then each C2 function. Good charts display scores over time and across units, indicate significant patterns, and cite specific events that illustrate general findings or important exceptions. These examples are important because they make the abstract statistical patterns meaningful to the using unit. Comparisons with general patterns may also be helpful; as an example, "the finding that Blue unit locations were known to the command's standard about 65% of the time sounds low, but is significantly better than the typical division." Constructive suggestions for avoiding or overcoming problems may also be appropriate, but must be distinguished from ACCES evidence-based findings.

Final Report

Normally the final report is written after the bulk of the briefing charts are completed. Indeed, some of the elements from the most important viewgraphs often wind up as figures in the report. The general format includes:

1. background on the exercise and unit, largely drawn from the exercise control variables,

2. overall C2 effectiveness measures, over time and across CPs,

3. diagnosis of C2 process quality measures, function by function,

4. conclusions and constructive suggestions.

Good reports stress what went well in addition to what went wrong. They always include a brief executive summary.

The application report is the culmination of the evaluation. It should provide an accurate and clear picture of what happened during the application, and of how the evaluation was conducted. It also should contain sufficient data to support all statements made in the written text. The report format has been successfully been applied in the past, but each application is unique and therefore discretion should be

used by the authors. The accumulated data should also be preserved in some form other than the report, both with an eye to thew scientific and historical record, and in the interests of future developments of the ACCES methodology. Often this means putting the aggregate data in appendices.

Archiving ACCES Data

Before closing the effort, the application manager is responsible for archiving the ACCES data. This involves two separate tracks. First, the paper trail is organized and filed for later use by other researchers. This includes organizing observer notes, exercise materials, data reduction forms, and analytical scoring materials. These materials should be catalogued, labelled, and secured. Second, the item-level scores are transferred, in digested form, to the ACCES database. The Army Research Institute (ARI) will provide the current database structure and codebook if they are not already present.

Proper archiving is crucial to the ARI goal of better research on C2 and a richer understanding of the Army's command and control processes. This step has been a problem for some prior applications, so it must be given proper attention.

WORKING PAPER

WP LVN-91-02

ASSESSMENT OF FUTURE BATTLE LABORATORY'S CORPS COMMAND POST TECHNOLOGY INSERTION

Jon J. Fallesen

March 1991

Reviewed by: JON J. FALLESEN
Leader, Staff Operations Team

Approved by: STANLEY M. HALPIN
Chief, Fort Leavenworth
Field Unit

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

ASSESSMENT OF FUTURE BATTLE LABORATORY'S CORPS COMMAND POST TECHNOLOGY INSERTION

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ASSESSMENT OF FUTURE BATTLE LABORATORY'S CORPS COMMAND POST TECHNOLOGY INSERTION

Purpose

The purpose of this report is to document the findings from the insertion of command and control (C2) system technologies into a Corps command post. This report is intended to 1) provide Future Battle Laboratory (FBL) with information for refining the command post equipment and its application in V Corps and 2) identify broader, long-term requirements for emerging and future Army C2 systems.

Background

In December 1989 the Commander-in-Chief US Army Europe tasked FBL to explore and develop specific command post technology applications. FBL has been leading this effort, first with VII Corps as the target user, and since December 1990 with V Corps. An exercise was conducted in December 1990 when preliminary versions of the command post technologies were available for use. During that exercise the technologies were not heavily used for command post operations, but the targeted users provided excellent comments based on demonstrations they received. An evaluation report was submitted by Titan to FBL on those findings and recommendations for improvement (Titan, 1991).

During 16-20 February 1991, V Corps employed the command post technologies during their mobile subscriber equipment (MSE) capabilities exercise (CAPEX). The CAPEX involved the Corps headquarters and selected subordinate elements deploying to field locations and conducting simulated command post exercises. V Corps also used the CAPEX to try out the FBL-developed technologies. ARI, as requested by FBL, supported the assessments to identify and capture findings from the use of the command post technology insertion.

Approach

Direct observations of the use of the system technologies were made during the exercise. Informal interviews were held with the intended users of the technologies, and discussions among the Corps staff on how to use the technologies were observed. The assessment was done cooperatively with LTG (Ret) Forman, Titan, who supported FBL in designing and evaluating the command posts and their technologies. Comments were also captured from the FBL project leader, Natick RD&E Center ISO deputy project leader, and contract technicians. Written surveys were distributed to the core staff of officers manning the CG ISO

shelter (known as the law firm). Two of five officers completed the survey.

The technologies which were available to the commander and staff were considered from basically four perspectives:

1. Are the technologies appropriately transitioned to the users?
   (a) Is a training (or familiarization) program developed and followed? Is it matched to the audience?
   (b) Are capabilities understood by the users?
   (c) Are the technologies supported by technicians and maintainers so users can focus on operational capabilities?

2. How much are the technologies used?
   (a) Who uses them? How often? What for?
   (b) Do the users find new uses for the technologies?

3. Do the technologies change performance? Is performance improved?
   (a) Can users effectively interact with each technology?
   (b) Do the technologies lead to noticeable (or projected) improvements in C2 systems performance?
   (c) What errors are made?

4. What changes in the technologies will make them better?
   (a) How can the interaction with the operator, user, and maintainer be improved?
   (b) How can the contributions of the technologies be better incorporated into C2 operations?

Command Post Technologies

The command post technologies under assessment included the following.

Large Scale Copier

A large-scale engineering copier was placed in the Plans ISO shelter to make paper copies of overlays or other large source material. The operational objective was to reduce the time and manpower to reproduce overlays, which are often copied by hand.

Transfer Workstation (TWS)

The TWS involves equipment to scan an overlay or other source material into a digital format, and software to rescale it, transmit it over tactical communications (FAX and MSE), and plot it. The operational concept involves replacing manual copying and delivery of map overlays by automated distribution of overlays. The objective was to reduce the time to reproduce overlays and reduce the time and manpower to deliver them. TWS was located at the plans ISO shelter with a large scale scanner, color scanner, large scale plotter, AN/UXC-7 FAX, MSE telephone, and 386 type personal computer (PC). A portable PC, FAX, MSE telephone, and large scale plotter were located at a subordinate Division command post to receive and plot transmissions.

Large Screen Display and Video Control Unit

A large screen display was located in the CG ISO shelter for presentation of video or workstation images to the CG and his special staff. The large screen display had a 70 inch diagonal with 1280 x 1024 resolution. The large screen display image was controlled by a preview workstation. This workstation consisted of two consoles. One contained six 9 inch preview monitors showing the available images. The other console contained two monitors, a router switch for selecting the image to present on the large screen display, and a color video copy processor for producing a hard copy of any snapshot taken from any of the monitors. A video tape recorder was also available for recording or playing. The specific images which were available for viewing including the following:

Plans ISO remote-control map camera
Plans ISO conference camera
Current operations remote-control map camera
CG ISO remote-control map camera
CG ISO conference camera
Maneuver Control System (MCS)

Multi-dimensional modeling (MDM) terrain visualization workstation
Condensed Army Mobility Model System (CAMMS)
USAREUR Tactical Command and Control System (UTACCS).

A console identical to the six monitor version was also located in the Plans ISO. An LCD projection system and a 26" RGB high resolution monitor were also available for viewing displays.

Terrain Analysis and Visualization

Several capabilities were intended to be available for terrain analysis and visualization. None of the systems were fully operational because of limited source data available at the time of the exercise. The MDM did not have SITMAP data for the Corps area of interest but did have elevation and some vegetation data. MDM provided for 3-D draping, changing point of view, animated fly-through, and magnification/zooming/panning. None of the following systems had any source data for the Corps area of interest: the Battlefield Planning System (BPS) hosted on the MCS hardware, CAMMS, and UTACCS. As a result BPS, CAMMS, and UTACCS were not used for operational planning during the exercise.

ISO Shelters

Two International Standard Organization (ISO) shelters of 8 x 19 x 24 feet (when expanded) provided the workspace for command and plans cell personnel and to house the C2 system technologies.

Observations

A great deal was accomplished in the prototyping development effort in a short time. Many of the following assessment comments indicate concerns or refinements in the operation of the candidate technologies. The comments are not to detract from what is seen by this author as remarkable accomplishments given the constraints of time and other resources under which they were developed, integrated, and inserted into the operational command posts. Many of the suggested improvements already have been recognized by the development team or were part of the original design objectives. The information will serve to reinforce the existing requirements and findings.

The remarks in the following section are categorized according to the systems under observation in the exercise. It is important to qualify these remarks by some general indications of how the technologies were approached by the intended users.

Prior to the start of the exercise, the intended users of the technologies and shelters were to be trained or oriented in the use of the equipment. Formal, structured orientation did not occur, and as a result the staff did not readily engage in the use of the technologies. The personnel did not appear hostile to the use of any of the technologies, but they did not have a sense of ownership or motivation to use the technologies extensively during the exercise. Also prior to the exercise there was no individual within the Corps who "championed" the systems to help ensure that they were integrated into the command post operations.

How the technology is transitioned to the users is as important as the technology itself. Lussier (1986) and Riedel (1988) have addressed this issue and provide important considerations for doing the transition.

- "Change-agents" (the individuals who can deal in both the military and the computer domains) from the unit should be identified, employed to refine requirements, and facilitate acceptance by the unit.

- Integration of the automation must occur into the total system operation. Although the implementation should occur gradually and in phases, the impact of even a few new capabilities must be projected on the workings of the entire command post operation.

- To assess the effects of the technologies on system performance, the effects of extraneous factors should be controlled and minimized.

- The entire staff should be oriented in advance as to the

goals and objectives of the technology insertion and any evaluation criteria.

• To foster acceptance, confidence should be built by doing what can be done well. It is better to leave them wanting the next application or improvement, than to swamp them with more than can be absorbed.

The nature of the exercise was a contributing factor to the low use of the technologies. The first half of the exercise was emphasizing a communications exercise as a test of MSE. Also the computer portion of the exercise was planned[1] to run for 12 hours a day, unlike many CPXs which are round-the-clock operations. Some training on the technologies did occur on an ad hoc basis, but overall the staff did not appear to realize the intent or full extent of the system capabilities. Often the technicians or other non-V Corps personnel operated the equipment for them. One exception was the MDM which was used fairly extensively by a number of personnel. Another exception was on the final day of the exercise when the CG conducted the battle from his ISO shelter, using the large screen display to view MCS and remote video.

The transition of the technologies to the users occurred at an early phase in the overall development process. This must be kept in mind as the assessment observations are reviewed. Early transition brings with it some risk, but the philosophy of rapid prototyping accepts this risk and seeks early user assessments and information to shape the systems' development.

Observations of the operations in the shelters and use of the C2 technologies were recorded from 13 to 20 February. Table 1 in Appendix A lists the observed events.

Large Scale Copier

<u>Training</u>. Some guidance was given during hands on operation, but copying required little training. Instructions attached to the copier appeared to be sufficient for operation. Technical assistance was provided during equipment failures.

<u>Users</u>. The copier was used primarily by enlisted personnel from the plans cell, though on two occasions officers made copies directly. Two operators were used for copying large materials.

<u>Usage</u>. Five successful copy attempts were observed during

[1] The actual running of the computer simulation varied due to physical moves of the command post and other factors.

the exercise. Three of these were copying large overlays, one occasion was to copy a large worksheet or template, and the other occasion was to copy 8 1/2 x 11 materials for a briefing. In four instances difficulties were encountered: (a) not pre-cutting the copy paper prior to copying and the drag created by the weight of the roll kept the copy paper from properly feeding into the copier; (b) thick source materials, made up of several overlapping pieces of paper, were attempted but did not run smoothly through the copier; (c) too small of a piece of copy paper was feed through the copier and was not ejected automatically; and (d) the shelter sat at a slight incline and the toner needed to be redistributed for better copying and the copier leveled.

Discussion. The December evaluation attributed the low usage to the fact that G3 administrative support had a similar copier, but one which produced multiple copies. The need to have a similar capability in the Plans ISO shelter should be reviewed. The Plans ISO workspace may be better utilized by reserving it for staff planning functions than administrative copying.

Transfer Workstation (TWS)

Training. Instruction was given to the operators at the time of usage. The instructions were step-by-step in nature.

Users. TWS was used by an enlisted and an officer. When difficulty was experienced, the technical support personnel took over the operation to facilitate instructions to the receiving end of the transmission and to trouble-shoot the communications problems.

Usage. On 16 February the necessary equipment to receive TWS transmissions was delivered to the 8th ID and was successfully tested. Two successful transmissions were made subsequent to this. The first took 53 minutes from scanning to acknowledgement of receipt. The second took 1 hour and 45 minutes. Much of this time was taken by trying to get access to the communications. These times included multiple attempts at the procedures of sending and receiving. The second transmission involved a work-around by scaling down the overlay to reduce the length of the transmission. On the second transfer occasion the user had to wait over 2 hours for a meeting in the Plans ISO van to end before there was sufficient room to use the TWS equipment. The reasons for operating difficulty appeared to be because of unfamiliarity about operation of the interface between the FAX and PC and the unavailability of communications. The low usage of TWS is due in part to staff disagreements about whose responsibility it was to distribute overlays: liaison officers or G3 plans.

TWS was also successfully demonstrated to plot at various user-specified scales. The plotter in the ISO Plans shelter was used for operational applications only once.

Discussion. The December exercise report indicated that the TWS required too much training for the operator and that simplified operating procedures were needed. Various aspects of the user interface were closely examined to further explore this claim.

Menus. The menu could be made more usable by organizing it according to logical groups of commands. Currently there are 12 command lines all grouped together. Commands seem to fall into the following groups: scanning operation, viewing the scanned image, sending and receiving, and FAX operation. Menu language should be what is most familiar to the users and consistent. For example "data files" and "image files" are used on the menu, referring to the same thing.

A suggested alternative is:

Control Scanner

Set Image Directory
Select Image
View Image
Zoom Image Display
Plot Image Display

Send Image to AN/UXC-7
Transmit Image via AN/UXC-7
Receive Image via AN/UXC-7
Store Received Image

Operate AN/UXC-7

Quit

Explanations. The TWS dialogue uses quite good explanations. For an experienced user these explanatory screens would not be needed and are likely to become an irritant. Recommend that an option be given for operating modes with and without explanations.

Changing scales. The TWS requires the operator to remember the scale of the source material. Any of several instances could easily cause an operator not to know the source scale: numerous files, materials scanned in by others, and lengthy delay between input and scaling. The TWS should require the operator to enter the original scale upon creating the file and saving this source scale with the file. Another useful

feature would be to have TWS automatically compute the scaling factor for a given size of output, such as 8 1/2 x 11 size.

The Transfer Workstation (TWS) has great potential to save time in plotting and transmitting large size overlays and other materials. The success of TWS was demonstrated through transmissions of test materials and two tactical overlays. The limited usage did not provide an adequate test of the TWS capabilities or advantages, nor did it adequately allow a sufficient number of attempts to train or routinize procedures. The current operating procedures and user interface do not appear to be overly complex, but further analysis and development of the interface is recommended. Design guidelines referenced in the Bibliography are suggested for user interface design principles and methods. Flow diagrams of current user operations should be developed to determine where menu use and dialogue can be simplified and made more natural, especially where AN/UXC-7 and PC operations overlap.

Large Screen Display and Video Control Station

Training. Training in the operation of channel selection at the control station was given to several officers and several enlisted audio-visual specialists. Four audio-visual specialists were trained in the operation, each for a period of about 30-45 minutes. Those trained did not operate the station at a later time. Training for convergence of the display, stowage, and set-up was given to 1 officer.

Users. The large screen display and preview control station were typically operated by technicians, because the staff did not take an active interest in operating it.

Usage. The CG used the large screen display on four occasions. When the CG was present he viewed the MCS screen the highest proportion of time. The large screen display was used once to display an ongoing briefing in the Plans ISO shelter to an overflow crowd. Most of the time no one from the staff operated the large screen display or the preview control station. Technicians were usually not given specific guidance on what to display. Much of the time the technicians displayed source displays that were anticipated to be of interest. Overall MCS, MDM, and the Plans ISO map camera were displayed about equally. The control station console in the Plans ISO van was not used.

Discussion. The CG expressed a desire to have the capability to draw battlefield graphics or annotations on a tactical situation map and to disseminate them in real-time to multiple viewers, and to be able to communicate by voice at the same time. The Chief of Staff also requested the simultaneous

display of multiple views on the large screen display. (This could be done through the freeze-frame "multi" capability of the photo copier to show a static picture.)

Equipment difficulties and back-up. Incorrect power source caused the failure of the large screen display power supply. The LSD projection system was used as an alternate until the power supply in the large screen was replaced. The projection display did not appear to be well received because of its lower picture quality, contrary to what was reported in the December evaluation report. A scratch on the large screen display screen was discovered, which points to the need for caution when sliding the screen for set-up and stowing adjustments.

Human factors issues. The placement of controls hampered the operation of the video equipment. One example was the video switching unit which should be below the video monitors, not above it, so the operator's arm does not block out the view of the monitor. Another example was the location of the control panel for tilt/pan/zoom control of the cameras. This was inadvertently activated when an occasional viewer leaned against the face of the console. The control panel for signal selection was difficult to operate because of the few numbers of controls used to perform many types of operations. The control panel was preprogrammed to perform standard operations, but the need to depart from these standard operations was difficult to perform with the cryptic button labels and display panel. This finding supports the December finding on the need for simplification. The December recommendation to have an operator's job aid to assist in the operation was not accomplished.

Video cameras. The preview and video equipment provided very good pictures (although the preview monitors provided images which were too small to serve as monitors for an officer requiring to read typical displayed information) and the components were of a desirable size. The remote-controlled cameras hung fairly low and present a potential safety and health hazard as was evidenced by the knocking down of the camera unit in the current operations van (where the ceiling is lower than in the ISO shelters). Source audio should be available for each site where there is source video. Opaque instead of clear acetate should be used for map overlays (drops) to reduce glare picked up by the relatively fixed camera angles. The video was not heavily used during this exercise. Its real benefit versus the overhead costs (equipment investment, operator, dedicated lines, etc.) of supporting it may not be justified.

Video intrusion. SOPs should be established for the taping or transmitting of video to other sites. Often personnel did not realize that they were on camera or that the image was being transmitted to various sites. The CG and others may not want a particular meeting to be taped or viewed by others and should be reminded that the meeting is being taped or transmitted.

Photo copier. The photo copier was heavily used for the production of MDM three dimensional terrain. The usage suggests that a high resolution color printer be made available.

Summary.

Pluses

• The large screen has good resolution compared to other large screen displays.
• The large screen supports viewing by multiple officers.
• The large screen appears to be desired by commanders.

Disadvantages

• Because of contrast brightness limitations, the large screen must be viewed in low light.
• The clear protective cover acts like a mirror and reflects light (a slightly opaque screen would diffuse reflected light).
• The available viewing area for the large screen is fairly small. At the short viewing distances, the viewing angle is fairly narrow.
• The large screen takes up a good deal of shelter area.
• The effort required to make initial adjustments to the screen is considerable, (but the effort required to maintain convergence may be substantially less than what was observed during initiation and set-up).

Terrain Analysis and Visualization

Training. Hands-on instruction and demonstrations of MDM were given to many interested users. They appeared quick to understand and operate the system, but often tried to activate software functions which were not operable and sometimes became confused when trying to step back out of one function to go to another function or another map area.

Users. Users of MDM included officers, enlisted, and warrant officers. They included personnel from maneuver plans, engineer plans, fire support plans, aviation plans, and the topographic team.

Usage. Of all the various technologies available, the MDM had the highest interest and use by the staff. MDM was used on at least 15 separate occasions by various staff for applications varying from analyzing the air approach to a target area to deciding the best side of a river for defense. The system was observed to be used for viewing or analyzing the following:

- Terrain perspective
- Fly-through for aviators approach to target
- Fly-through for friendly and enemy maneuver approaches
- Locating defensive terrain
- Choke points, for killing areas.

Discussion. The features of MDM had known limitations going into the exercise. Many of the items on the user's menu screen had no functionality. Some of these were capabilities of interest to the users or items of curiosity. The effects on operations and planning of exaggerated elevation views is not clear. Some users seemed comfortable with this means of presentation, while others felt that the distortion would lead to inaccuracies. The users made suggestions for many changes. These suggestions along with the evaluator's recommendations are listed below:

The terrain view was restricted to the boundaries of a single lat-long block at a time. Recommend that the capability be provided to select cross lat-long blocks. (BPS has this capability and may be a source of code for doing this.)

Options not available from the menu should not be displayed, or they should be offset by a lower contrast background to show the operator that it is not available.

SIT-MAP data were not available for the exercise area of operation, so the test was limited. The draping of SIT-MAP data over terrain elevation was seen as too small of an area (approximately 1 km square grid) for much of the analyses of interest to Corps.

Within a lat-long block, locating areas has to be done by "eye-balling" terrain features or approximating distances. A grid overlay is needed, as well as a capability to go to a point specifying a UTM grid or to read the UTM coordinates of a location.

There may be a problem with the displayed aspect of MDM. The lat-long one minute grid was measured at 6 inches x 9 1/4 inches (a ratio of .648), while the given grid was supposed to represent 70 x 111 kilometers (a ratio of .630). This suggests that the view is stretched along the latitude.

Contrary to the December report, several users found the fly-through capability of sufficient value to work with it and to show others what the approach to a target area would look like. Fly-through settings (all settings: height, area, bearing, tilt, etc.) should be saved for each flight path. Multiple paths should be available for saving for each terrain area of interest, rather than 8 paths for all areas. A typical use might be to pre-designate many flight paths to show at a later time in a briefing.

On "fly-throughs" it would be desirable to have a small overlaid window showing a top view of the flight path with an indication of which "flight" segment is being shown.

A similar small window would be useful for movement through the 3-D space. One way to represent this mapping window would be to use a cube image with the viewed object, viewer's reference point, and light position.

The depiction of surface drainage was not well-received. The blue coloring of the lowest 10% of the terrain was intuitively associated with bodies of water. Surface drainage is typically looked at to observe a pattern (dendritic, trellis, parallel, radial, etc.). To display this, lines of drainage, rather than an area of low terrain, should be shown.

The utility of "very low" and "low resolution" is questionable. These two levels seem to be too coarse to provide much benefit.

The following additional capabilities would be useful:

- Trafficability and road networks
- Graphical and text annotations
- Major power lines
- Built-up areas
- Rivers
- Point to point distance
- Variable AGL during a fly-through
- Applications for terrain management, terrain deconfliction.

Alternate suggested menu terms for Movement (in the novice setting) include:

Zoom in	for	Forward
Zoom out	for	Backward
Tilt up	for	Up
Tilt down	for	Down
Rotate left	for	Left
Rotate right	for	Right
Change in magnitude	for	Speed
Change in angle	for	Angle[2]

Responses from User Questionnaire

Because of the low usage of the command post technologies, the questionnaires were not distributed extensively. Two questionnaires were returned from a total of 5 distributed. The responses are given at Appendix B. Both respondents were members of the "law firm". Their duty positions were special assistants to the Corps Commander. They had been in the position from 3 to 4 months. Respondent A had an armor background and Respondent B had infantry. The respondents had 6 and 3.5 years in grade (Major) respectively and 17 and 14.5 years in service. Both had prior experience with computers, with at least daily use of PC-type computers. Their responses indicated generally favorable comments on the shelters and C2 system technologies. They had many good comments for improving the systems.

Work Areas and ISO Shelters

Training. Training for V Corps personnel on the set-up and tear-down of the ISO shelters did not occur until the fourth day of the exercise when the Headquarters was displacing to its second location. A second opportunity for stowage occurred two days later at the end of the exercise when the Headquarters prepared to return to garrison. Training was given to the law firm personnel on the CG ISO shelter and to various enlisted personnel on the Plans ISO shelter. Upon set-up back in garrison by the technicians it was noted that the internal equipment was not stowed as securely as it should have been: not all equipment consoles had been taken off their casters and some straps were left loose. No apparent damage appeared as a result.

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[2] Or alternatively change the software so the entered angle represents the actual angle, not an amount of change to the actual angle.

Users. The Plans ISO shelter was not used on a full-time basis by the plans cell. The plans cell retained their 5-ton expansible van and normally operated there. The Plans ISO shelter was used on an intermittent basis for meetings for maneuver planning and deep target planning and briefings to the CG or Chief of Staff. The Plans ISO was also used occasionally as an isolated work area for individuals of the plans staff.

The CG ISO shelter was manned full-time by one or more representatives of the "law firm". Their role and function on the staff was being defined as the exercise progressed. At the conclusion of the exercise they performed battle execution functions at the guidance of the CG. The CG operated from the CG ISO shelter on occasion, as did the Chief of Staff. In addition to conducting the battle from this location, the shelter was frequently used as a meeting place for matters not dealing with the execution of the exercise (for example, refining headquarters and command operating procedures, meeting with visitors, and discussing technology requirements).

Usage. When the CG or Chief of Staff were not present, the CG ISO van was under-utilized. This was probably due to the lack of definition of the role of the law firm, and the fact that it evolved through the course of the exercise. One possible role which was discussed would be to travel with the CG and control the battle while he met with others. Depending on the amount of time that the CG and his special assistants would be away from the Corps Main, the CG ISO facility may be more efficiently used for other functions.

In the Plans ISO shelter operators and users were prevented from physical access to a workstation to use it when long meetings with many people took place. Some of the equipment would be better located elsewhere. For example, the large scale copier and the transfer workstation (TWS) may better serve their functions in administrative areas.

Discussion. Through the course of the exercise and the set-up and preparation for deployment many suggestions for additions to the workspace were made. Some of these come from the evaluators, but most from the staff themselves.

Sound-deadening and privacy curtains are desired among the CG and Plans shelters.

Additional storage is needed for general command post supplies (acetate, manuals, maps, safe, etc.)

Briefing software is needed which is compatible with Corps software.

Although the ISO lighting is very good, directional lighting is required for the special work areas in a command post. Less light is needed around computer displays and more light is required on paper maps and charts. The current lighting does not allow this flexibility.

Quick connect-disconnect connectors are needed between the two vans.

The stowage locations are marked on the floor, but there were questions as to what piece of equipment goes with which marks. Sometimes pieces of equipment were shuffled about, trying to match the correct equipment with the right location. A load plan diagram or descriptive marking on the floor and/or equipment should be used.

The law firm estimated a desired 42" wide workspace for two personnel working side-by-side, with greater depth to the working table, and narrower cabinet depths (MIL-STD 1472 recommends a minimum of 30 x 16 inch working surface for each individual.)

The law firm would like the 9" monitors replaced with four 12-14" monitors, one for each of the 4 horsemen, and selectable views on the monitors. They would like a PC located adjacent to their work area.

The law firm would like to condense the video control workstation to two thirds of its width, which could be accomplished by stacking some of the components. They envision operating the workstation and locating near their work area.

The law firm would like to use the 4 horsemen workspace layout to screen access to the CG in the CG ISO shelter.

The law firm desired to move the CG as far back from the large screen as possible.

The CG should have a remote pointing device for the large screen.

The law firm desired to have MSE hook-ups on the exterior of ISO, with the ISO pre-wired. (This feature was previously anticipated but was not implemented because of the lack of signal personnel to make the installation.)

The CG and law firm desired to have a "magic board" (dry-erase board with print capability) located near the large screen.

The capabilities should include access to present Harvard

graphics briefing charts on the large screen display.

The Chief of Staff noted that he would prefer a swivel chair for the CG without arms, so he can sit down with gas mask and holster.

The Chief also desired to have backs added to cover the console.

The law firm wanted to move MCS and UTACCS against the fore wall of the shelter.

The law firm also seeks flexibility in the work area designed to support missions and roles that will be defined later.

During observation and participation of set-up and tear-down of the ISO shelters several improvements were identified.

During set-up, the Upper Jack Attachment caught against the bottom of the Support Bracket several times. The bottom of the Jack Support Bracket which is against the side wall should be angled instead of perpendicular to the wall, so the attachment would not catch but slide.

The level lines on the end walls were difficult to see from the position where the jack is cranked from. A more prominent level line would help, possibly something which projects slightly from the end of the side wall and the end wall, so the person cranking can read the level line without physically moving away from the crank.

A small grip would be useful on the end wall so that the soldier using the crank can pull the end wall out to align it with the floor gasket. Sometimes a small rubber bumper is used for this purpose. Reshaping and sizing the bumper to have finger holds would be a simple solution.

Jacks which are stowed on the interior shelter doors should be removed during operation for those doors which are primary ingress and egress locations. The ground plates have a tendency to catch clothing, web gear, and other materials. Alternative stowage location may be better located under the prime mover chassis.

The jack handles for the Jack Supports should be collapsible against the frame of the jack.

The shelter-to-shelter passageway and insulation kit is difficult to install, and modified set-up should be explored. The primary difficulty seems to be in the coordinated expansion of the passageway among different

individuals while preventing the passageway from binding in the opening. Adding an articulated joint to the floor segment, similar to the wall segments, may facilitate installation. The web straps for the stowage kit were prone to tearing and breaking.

A cable run would be useful around the fuse box to prevent cables from being run through the port and across the fuse box, preventing access to it.

Storage should be added for the corner brace (floor to outside wall) on the inside of the rear door.

Conclusions

The assessment of the C2 system technologies was limited by the inability to accomplish an adequate transition of the technologies and shelters to the Corps staff prior to the exercise. A training program was needed, not so much as to instruct the users in operating equipment but for purposes of clarifying the intent of the technology insertion and orienting them to the use of the new technologies. The importance of a training program would be to get the staff to make an investment into the technologies before the opportunity to use them. Early involvement will allow the intended users to start to see what changes in procedures or capabilities are likely. As there was no formal training or orientation period the use was ad hoc, and as a result the frequency of use was low and capabilities were under-utilized.

Unfortunately the usage was so low that it is not appropriate to generalize findings from this exercise to broader C2 system requirements. What usage there was, was closely guided, monitored, or operated by the team of FBL personnel and technicians. As such any desired information for requirements for future C2 systems on manning, manpower, personnel skills, potential benefits, and even equipment functions was limited by developer intervention and the low usage of the technologies.

The best example of an active command post, when the technologies were exercised the most, came on the final day of the operation. At this time the CG conducted the battle from the CG ISO shelter. He used the large screen display to view the current situation. An MCS operator at a near-by MCS workstation controlled the view of the situation at the CG's commands. The CG obtained the new locations of enemy regiments from subordinate commanders and had the locations entered into the MCS data base. The CG ranged field artillery weapons to the enemy regiments using the MCS to estimate distance and gave commands for targeting to the fire support coordinator who was present.

The CG also viewed the current operations map via video link to that cell while talking over MSE telephone to a current operations officer. As the officer answered the CG's queries he pointed to the locations on the map, which the CG could see on the large screen display.

Officers from the law firm assisted in coordinating guidance or obtaining information on behalf of the CG. They also assisted the MCS operator by verifying grid coordinates.

During this period of about 90 minutes of fairly intense activity, some of reliable operating requirements of the workspace and C2 systems started to become more evident. The law firm began to better see how the technologies could be used and

what changes were going to be desirable.

On the Plans side, there was never a complete adoption of the shelter or the technologies. The primary area for plans activities was their usual 5-ton expansible shelter. There was no apparent sense of ownership or real interest in the ISO shelter or technologies, other than for its expansive work space. The MDM terrain visualization system received considerable attention as an individual staff tool, but there was not any apparent consideration for how it could be better integrated into staff operations or how staff operations or organization might change because of it.

Because of the lack of transition in terms of a prior training or orientation program a concern is raised about future enhancements to the command post work areas and system technologies. When there was discussion among the staff about revamping the CG ISO shelter workspace or adding more ISO shelters, there was little identification of functional requirements. **Changes were being addressed without identifying the underlying functions which the equipment or workspace must support.** To fully support the four horsemen or law firm concept, the concept must be defined sufficiently to identify how the existing technologies can be used or what different ones are needed. The functional analysis should identify how operations are different when the CG is present and when he is away. **Without careful consideration to the functions required in the workspaces and the desired flow of information, costly excursions with no practical benefit could easily be made.**

In conclusion, the technologies operated successfully and were sufficiently reliable to endure tactical deployments. The technologies received a fair degree of user acceptance, but were not in great demand during the exercise. The level of usage and focus on the technologies for assessing broader C2 system requirements was not as great as desired. There were encouraging outcomes of the technology insertion, including the CG's use of the video link to current operations, the exploration and usage of the terrain visualization system and refinement of its capabilities, and the CG's use of the large screen display. The commander and staff appeared sincerely interested in enhancing the suite of technologies and the supporting work area for future operations.

Future exercises will provide additional opportunities for identifying C2 system requirements and assessing these and other candidate technologies. To ensure that the maximum combat developments potential is realized, the technologies must be thoroughly user tested. Greater use will depend on

- ensuring that the technologies support required functions and information flow and are not based on unfounded

preferences,

• developing and implementing a transition program to address the "soft side" (orientation, training, manning, unit SOPs) of the technologies, and

• increasing user acceptance by encouraging system "championing" from within the organization.

Bibliography

Benel, D. C. R., & Benel, R. A. (1984). Use of group viewing displays for SHORAD command and control. US Army Human Engineering Laboratory Technical Note 8-84. Aberdeen Proving Ground, MD.

Card, S. K., Moran, T. P. & Newell, A. (1983). The Psychology of Human-Computer Interaction. Hillsdale, NJ: Lawrence Erlbaum Assoc.

Department of Defense. (1987). Human engineering guidelines for management information systems. DOD-HDBK-761A.

Fallesen, J. J. & Quinkert, K. (1990). Workspace design handbook for standardized command posts. ARI Research Product 90-29.

Fox, J. A. (1989). DRUID: Dynamic rules for user interface design. Hypertext Software. Bedford, MA: Mitre.

Galitz, W. O. (1989). Handbook of Screen Format Design. Wellesley, MA: QED Information Sciences, Inc.

Lewis, H. V. & Fallesen, J. J. (1989). Human factors guidelines for command and control systems: Battlefield and decision graphics guidelines. ARI Research Product 89-01.

Lussier, J. W. (1986). Guidelines for automation: A how-to manual for units receiving automated command and control systems. ARI Research Product 86-24.

McGee, K. & Matthews C. (Eds.) (1985). The Design of Interactive Computer Displays: A Guide to the Select Literature. Lawrence, KS: The Report Store.

MIL-STD-1472. (1989). Human Engineering Design Criteria for Military Systems, Equipment and Facilities. Washington, DC: Department of Defense.

Obermayer, R. W. & Fallesen, J. J. (1990). Human-computer interaction in tactical operations: Designing for effective human-computer dialogue. ARI Research Product 90-31.

Riedel, S. L. (1989). Evaluation of an engineering copier for use in Army command posts. ARI Research Note 90-04.

Riedel, S. L. (1988). User acceptance and field implementation of decision support systems. ARI Research Report 1477. AD A200 412

Smith, S. L. & Mosier, J. N. (1986). Guidelines for designing user interface software. ESD-TR-86-278. Electronic Systems Division, AFSC. AD A177 198

Titan, Inc. (1991, January). CINCUSAREUR Command and Control Project Evaluation Report. Draft evaluation report.

Appendix A

Listing of Observed Events

Table 1. Observed events in CG and Plans ISO shelters.

Date-Time	Event
0200 14FEB	ISO's set-up at Fliegerhorst
0745 14FEB	Targeting meeting in plans ISO
0900 14FEB	Concept meeting in plans ISO
1015 14FEB	G2 inquired about using MDM to traverse routes
1050 14FEB	Demo of MDM to AVN NCO
1830 14FEB	Large scale copier used
0730 15FEB	Meeting with 19 people in plans ISO van
0920 15FEB	Briefing to COS in plans ISO
1055 15FEB	MDM used for analysis of terrain elevation.
1220 15FEB	Two soldiers come for additional MDM print outs.
1320 15FEB	Report of jamming of large scale copier because of thickness of source material
1400 15FEB	CG briefing, used MDM on large screen display to show elevation and corridors
1720 15FEB	Four copies made on large scale copier (nomograph worksheet)
1750 15FEB	Two topo team reps use MDM to produce 8 top views
1000 16FEB	CG in CG ISO discussing Cdr info needs, large display, MCS info, etc.
1020 16FEB	Plotter, Fax, and PC sent to 8th ID
1115 16FEB	Plans meeting in plans ISO
1330 16FEB	Receipt of test overlay transmission acknowledged by 8th ID

Table 1. (continued)

1400 16FEB	Targeting planning meeting in Plans ISO with 25 participants
1410 16FEB	Plans requests MDM display
1420 16FEB	Plans has an overlay to send, cannot access equipment because of meeting
1525 16FEB	Training plans SGT to send overlay
1532 16FEB	Overlay is scanned in TWS
1535 16FEB	Targeting planning meeting reconvenes
1545 16FEB	8th ID acknowledges receipt of overlay, but cannot plot
1625 16FEB	Fourth attempt at overlay transmission works and is acknowledged
1700 16FEB	Targeting planning meeting reconvenes
1800 16FEB	CG at CG ISO
1825 16FEB	Aviation rep working on deep targeting uses MDM to look at target areas and approaches
0745 17FEB	Plans eng. using MDM to view defensive terrain
0900 17FEB	CG at CG ISO
0910 17FEB	Topo team request use of MDM, but being used by Plans eng.
1026 17FEB 1230	CG returns to Plans ISO for situation briefing
1300 17FEB	Deep target planning uses MDM
1345 17FEB	CG meets with COS & G2 in CG ISO
1440 17FEB	MDM print outs made for 8th ID
1610 17FEB	3rd AD CG meets with CG, deep target planning continues in Plans ISO
1730 17FEB	2 MDM print outs made for deep target plans
1800 17FEB	Plans use MDM to analyze terrain

Table 1. (continued)

	18FEB	Corps CG meets with CINC
0920	18FEB	Started tear-down
1100	18FEB	Tear-down and stowage complete
2200	18FEB	Set-up complete at Downs Barracks except for power and test
0800	19FEB	CG in CG ISO, COS in Plans
0850 0955	19FEB	CG meeting in CG ISO
0930	19FEB	Large scale copier used to make 20 regular size copies
1010 1055	19FEB	CG meeting in Plans ISO
1300	19FEB	CG meets with CAC Cdr, etc.
1310	19FEB	Two plans officers working on OPLAN in Plans ISO
1330	19FEB	MDM used by Plans engr
1435	19FEB	Plans inquire about sending overlay and reducing an overlay
1610	19FEB	Overlay scanned in to send to 8th ID, transmission delayed because of busy MSE number
1700	19FEB	MSE still busy
1700	19FEB	Large scale copier being used, toner needed to be re-distributed because of ISO van not being level
1710	19FEB	MSE lines are down
1755	19FEB	Overlay scaled down to 2 - 8 1/2 x 11 pages and sent
0800	20FEB	CG in CG ISO van, discussing MCS acceptance
0830	20FEB	Power problem, lights are out in Plans ISO
0900	20FEB	Plans officer using MDM to print out area of interest

Table 1. (continued)

0910 20FEB	G3 plans continues to work w/CG, G2, Avn in CG ISO
0915 20FEB	CG starts closely controlling the battle from the CG ISO van using MCS map graphics on large screen display
0930 20FEB	CG goes to Plans ISO for call w/ 8th ID CG, receiving coordinates for boundaries, phase lines and unit locations, CG returns to CG ISO
0951 20FEB	MCS operator updating locations of 2 enemy regiments
1005 20FEB	Enemy data loaded in MCS and displayed
1007 20FEB	CG views current operations video
1030 20FEB	CG directs MCS operator to locate and calculate distance from a Lance to a target
1045 20FEB	SGT operating TWS to scan in an overlay
1053 20FEB	SPEC gets print out of MDM w/surface drainage for topo team
1130 20FEB	CG getting briefing on defensive operation from plans in Plans ISO
	COS gets briefed on 4 horsemen concept by law firm
1300 20FEB	CG departs to go to TAC
1300 20FEB	Overlay never sent because of a reported comms problem
1340 20FEB	Plans meeting in Plans ISO, apparently on AAR
1515 20FEB	Re-trying transfer of overlay via TWS
1600 20FEB	SGT trying large copier, had difficulty feeding curled acetate overlay in, small piece of copy paper became jammed, difficult to clear it out
1620 20FEB	Scanning in an overlay on TWS
1625 20FEB	SGT using large copier again, made 3 copies
1627 20FEB	Possible problem with TWS computer
1705 20FEB	G2 announces that the war is over

Appendix B

Responses to Users Questionnaires on Functional System Requirements

Numbers below represent the number of each question answered. Missing or skipped numbers indicate that there was no response for these questions. If responses were the same or if only one respondent answered, a single response is given. The answers of the two respondents are identified separately when they differed.

Respondent A answered the soldier-computer interface portion of the questionnaire for the video control workstation:

1. Increase functionality of the work area, adding storage, and making the controls and printer easier to reach.

2. The information on the displays could be easily read and interpreted.

3. There was enough information.

4. The information was not more than was needed or used.

5. The organization of information was helpful.

6. The displayed messages were confusing. The interface was not intuitive, too many steps and illogical processes to move through to get to the answer.

7. Error messages gave enough information on how to correct errors.

9. The commands and procedures for using the different machines were not consistent.

11. The systems required different commands for similar tasks. The method for using systems varies by system, the interface is not intuitive. We need a single menu standard as a baseline with variations for each specific application, like the Macintosh computer.

Respondent A completed the commander/primary staff interview and gave the following answers:

1. The rigid wall shelters and equipment improved overall C2 functions. More storage and more communications are desirable.

2. The rigid wall shelters and equipment assisted the commander

in performing his duties. Better map resolution is desirable.

3. The rigid wall shelters and equipment did not facilitate planning for current operations, but did facilitate planning for future operations.

5. Need to add better interaction between systems and a "freeze frame grab capability".
6. The basis of issue of large or medium screen displays should be one each for CG, operations, and for each division.

7. Need good visual clarity display for large or medium resolution screen display.

8. The large (or medium) screen display operated effectively and efficiently.

9. Need dedicated system operators. Errors will result in information slow down or loss. Incorrect information will lead to incorrect assessments and recommendations.

Responses by both A and B were given to questions on the rigid wall shelters.

1. The size was rated as "about right."

2. The lights were rated as "about right."

3. Emergency lighting was rated as "too dim."

4. Emergency, back-up power was rated as "responded fast enough, but not enough power."

5. Respondent A indicated that the space allocated to specific pieces of equipment was adequate. Respondent B indicated that no the equipment needs to be rearranged to meet the needs of the CG.

6. The training on set-up and tear-down was "about right."

7. Both respondents felt that the shelter should be integrated into the current Corps TOE.

8. Respondent A indicated that the shelter was adequate for the application, Respondent B indicated that the resolution of maps on large screen TV were difficult to read the unit identification.

9. Both indicated that the shelter "met most needs" of the commander and staff.

10. The amount of time to set up the shelter was rated as "about right."

11. The number of people required to set up the shelter was adequate.

12. Both indicated that they would want the shelter as part of their unit if engaged in combat.

13. Both indicated that the shelter should be consider for further evaluation as a standard CP.

14. Would like a 386 PC with printer and muffler, more storage space, color-coded fuzes with wall outlet covers, larger coat hooks to hold helmet, LCE & other equipment. Need to decide who is responsible for shelter set up. Respondent B indicated that it was an excellent concept, some refinement is needed but works well, need multiple shelters for the Corps TOC. The ISO is better than the 5-ton expansible van.

Both respondents answered questions about the large scale copier:

1. Training was "about right."

2. Respondent A reported that technical support was not needed. Respondent B indicated that it was needed less than once per shift.

3. The staff officer most often determined what copies would be made.

4. The copier should be added to the TOE.

5. The copier was adequate for this Corps application.

6. Respondent A indicated that the copier "met almost all needs." Respondent B indicated that the copier "met most needs."

7. Respondent A indicated that the error messages were satisfactory.

8. Time to make copies was "about right."

9. Number of actions to make copies was "about right."

10. Respondent A indicated that the time to make copies was "not significantly different". Respondent B indicated that copies were made "faster" than without this equipment.

11. Respondent A indicated that the accuracy of copies was "not significantly different". Respondent B indicated that copies were "more accurate".

12, 13. Respondent A indicated that performance was "not significantly different". Respondent B indicated that performance was "higher in quality" and copies were "more useful".

14. Paper copies of overlays and standardized templates (planning worksheets) were materials copied.

15. Copies were used as template worksheets and to post maps.
16. Features liked least were: had to manually cut the paper.

17. Features most liked were: ease of use, reliability, and ability to make large copies.

18. Features to be added: accurate plastic overlays (no distortion).

19. Respondent A indicated that he would want the copier as part of the unit should they go into combat.

Both respondents answered questions about the large screen display and commander's preview station:

1. Training was rated as "about right."

2. Onsite technical support was needed from "more than once per shift" to "about once per shift."

3. Respondent A identified the Commander as the one who most often determined what displays would be presented. Respondent B indicated it was the staff officer.

4. Respondents felt that the system should be integrated into the Corps TOE.

5. The system was rated as not adequate for this Corps application: the resolution of MCS SITMAP was poor. A capability to work with the graphics and send out on MCS was desirable.

6. The displays were rated as "meeting most needs" of the staff and commander.

7. The amount of time to display the products was "about right."

8. Respondent A felt that the number of actions to operate were "too many". Respondent B felt that they were "about right."

9, 10. Respondent A felt that performance was faster with this system, but was "less accurate", though accurate enough to be tactically useful.

11. Respondent A felt that products displayed were "lower in quality, but no too low to be tactically useful.

12. Respondent A felt that the system allowed the display of products which were "more useful" than normally displayed and viewed.

13. Products displayed most often were: MCS SITMAP, MCS Cdr's Report, terrain mapping products (MDM).

14. The display was used to monitor the battle.

15. Features used most often: MCS screen magnification.

16. Features to be added: freeze frame capture for later output (display).

17. Respondent A indicated that he would want the LSD/Cdr's preview station as part of the unit if engaged in combat.

18. Respondent B indicated that MCS needs to be fully integrated in Corps before assessing the future.

WORKING PAPER

WP LVN-91-1

A CONCEPT FOR MEASUREMENT OF JOINT TASK FORCE SIX RESPONSIVENESS

Jon J. Fallesen

January 1991

Reviewed by: [signature] JON J. FALLESEN
Leader, Staff Operations Team

Approved by: [signature] STANLEY M. HALPIN
Chief, Fort Leavenworth Field Unit

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

A Concept for Measurement of Joint Task Force Six Responsiveness

Purpose

The purpose of this working paper is to propose an approach for measuring the performance of Joint Task Force Six (JTF-SIX).

Problem

The objective of JTF-SIX is to assist Drug Law Enforcement Agencies (DLEA) in their mission to detect, deter, and disrupt illegal narcotics trafficking. The JTF-SIX mission is to be responsive to DLEA. JTF-SIX is not directly involved in the actions of detecting, deterring, or disrupting drug trafficking. JTF-SIX is a command and enabling agent which coordinates with Department of Defense (DOD) elements for actions such as approval, deployment, and rules of engagement. Even though JTF-SIX is not involved in acting directly to detect, deter, or disrupt drug trafficking, the JTF-SIX is now driven to use the same direct measures of effectiveness as the agencies which they support. The measurement problem is twofold: (a) the measures used by the DLEA agencies have been subject to considerable debate as to their validity as true effectiveness measures in the 'war on drugs' and (b) the measures do not adequately address the command and control (C2) and support missions of JTF-SIX.

Background

Military support to Southwest Border DLEAs is mandated by the National Drug Control Strategy and is consistent with the President's designation of illegal drug trafficking as a threat to national security. All military support in the Operation Alliance Area of Operations is to be conducted in support of a DLEA. Federal military forces are prohibited by law from searching, seizing, arresting, or conducting any related law enforcement activity involving civilians. Federal and state national guard military forces may conduct detection and monitoring missions in support of DLEAs.

JTF-SIX representatives approached the Command Arms Command at Fort Leavenworth to obtain assistance on various issues. Measuring JTF-SIX effectiveness was one of those issues. The Fort Leavenworth Field Unit of ARI agreed to look into alternate measurement schemes for JTF-SIX, based on mutual agreement among representatives of JTF-SIX, Command and Control Integration Council, Future Battle Laboratory, and ARI.

Problem Analysis

In order to understand better what JTF-SIX does and to

determine appropriate measures of JTF-SIX effectiveness, functions and support actions were reviewed by ARI. Seven types of functions were identified and eight support actions. Types of coordination and information processing requirements were also reviewed.

TYPES OF JTF-SIX FUNCTIONS

Inform -- JTF-SIX informs DLEA about DOD and its capabilities.

Request -- Queries or requests from DLEA for JTF-SIX support.

Approve -- JTF-SIX requests approval from higher DOD authority.

Plan -- JTF-SIX plans and matches action to capabilities and availabilities and tasks DOD supporting element.

Support -- DOD supporting element supports DLEA request.

Monitor -- JTF-SIX monitors action and DOD supporting element and interjects any appropriate control.

Assess -- JTF-SIX obtains feedback from DLEA and DOD supporting element about disposition of action and makes assessment.

Facts

Several facts are stated as pertinent to improvement of measurement for JTF-SIX mission accomplishment.

(1) DoD has an assigned mission in the war on drugs. JTF-SIX has responsibility for the southwest border area of the US.

(2) The JTF-SIX mission is to assist DLEA in their actions to detect, deter, and disrupt illegal narcotics trafficking.

(3) Because of its organization, role, and authority JTF-SIX has a limited rapid response capability. Operations are deliberately planned and coordinated with DLEA, DoD supporting units, and JTF-SIX higher headquarters.

(4) JTF-SIX is organized as a command and control organization of about 200 staff personnel with no assigned DoD forces.

(5) JTF-SIX is not an action agent which directly detects, deters, or disrupts narcotics trafficking. The basic functions of JTF-SIX are of the same types as command and control for

TYPES OF DOD SUPPORT ACTIONS
(from JTF-SIX User's Guide)

Intelligence -- identify trends, techniques, and locations of criminal activity. Train personnel, provide help in intelligence preparation/analysis.

Ground surveillance -- provide sensors and surveillance systems with or without trainers and operators.

Airborne reconnaissance -- provide aircraft for surveillance of a given area.

Transportation -- in some cases DOD vehicles or aircraft can be used to transport prisoners, personnel, equipment or evidence (especially hazardous materials, heavy or oversized cargo).

Engineering -- various engineering support: clear vegetation, emplace or remove obstacles, improve roads, light construction, demolition of condemned facilities.

Area denial -- perform training exercises in an area as an area denial or as concealment or deception.

Ground reconnaissance -- man observation posts.

Mobile training teams -- provide instruction (small unit tactics, land navigation, vehicle or aircraft recognition techniques, camouflage techniques, marksmanship, staff planning and organization, basic first aid, vehicle maintenance, etc.).

operational forces: planning, coordinating, monitoring, and directing.

(6) JTF-SIX is now driven to use the same effectiveness measures as the agencies which it supports. These measures typically address the number of arrests, amount and value of narcotics confiscated, or the amount and value of equipment confiscated. Measures of this type have been referred to as 'body counts.' These measures have been attempted to be related to the availability of narcotics, the price of narcotics as influenced by supply and demand, or crime rates.

Assumptions

The following assumptions are about other characteristics of the JTF-SIX organization and style and the goals of measurement improvement.

JTF-SIX COORDINATION AND INFORMATION PROCESSING

JTF-SIX Internal Information

Organization
- Refine mission
- Refine operating policies
- Research legal policies
- Maintain resources

Plan

Decide

JTF-SIX Outgoing Information

DLEA interaction
- Educate DLEA
- Assist DLEA in expressing DOD support requirements
- Monitor DLEA actions supported by DOD

DOD supporting element interaction
- Inquire about DOD units' capabilities and disposition for possible missions
- Task DOD units with missions
- Monitor DOD units support to DLEA

Higher hq interaction
- Request approval for DLEA support
- Operating policies
- Status

JTF-SIX Incoming Information

DLEA interaction
- Receive DLEA inquiries
- Receive DLEA requests for support

DOD supporting element interaction
- Receive replies to possible missions
- Receive reports of status

Higher hq interaction
- Receive approvals or denials and other guidance

(1) The relationship between JTF-SIX effectiveness and the war on drugs is not direct, just as in C2 on a conventional battlefield has an indirect relationship to outcome. Battle outcome is highly dependent on the actions of the subordinate force and the capabilities of the enemy. The link of good or poor performance by subordinates can be compared directly to battle outcomes. The decentralized execution can overwhelm the actions of higher echelon C2. (There can be good or poor C2 combined with good or poor subordinate execution.) Effective C2 is assumed to provide a better chance for success by the force elements. This means that force outcome measures of actions which are not directly impacted by the C2 elements may provide

contrary indications of performance. The measurement of C2 performance is not constrained to force outcome measures but C2 diagnostic measures are also used.

(2) The goal of 'improving measurement' is to improve the measurement of JTF-SIX operations, not necessarily to develop improved measures of the 'war on drugs.'

(3) It is desirable to determine if secondary benefits accrue to the DoD forces or elements as a result of their involvement. The hope is that DoD elements can have a positive impact on illegal drug trafficking, while not jeopardizing their state of force readiness for conventional warfare or that their readiness can be improved.

(4) Measurement of JTF-SIX is assumed to be important to (a) determine if it is appropriate to continue the mission (if it should be reduced in scope, increased, or modified), (b) to improve the effectiveness and efficiency of operations, and (c) to provide accountability of their operations.

Restated Mission

It was concluded that effectiveness measures should be aligned to the JTF-SIX programmatic mission, at least augmenting measures of "direct" impacts on drug trafficking.

Concept

Primary effectiveness measures should focus on the **responsiveness** of JTF-SIX to DLEA requests, the **efficiency** of JTF-SIX processing, and the **adequacy** of JTF-SIX plans. The **resource impact** for conducting the operation should be measured and the degree of **achievement** of the goals.

Approach

Table 1 provides a summary of measures in these five areas and also includes measures which would provide information for improving JTF-SIX interagency coordination.

Table 1. Proposed Measures for JTF-SIX

Purpose	Measure	Definition	Source
Responsiveness	Percentage of requests supported	Number of requests supported/ (Number of requests supported + Number of requests returned/disapproved).	Internal JTF-6 records
Efficiency	Timeliness of approval	Time until approval is conveyed.	JTF-6 internal documents
Adequacy	Robustness of plan	Degree to which mission, schedule, assets, and area of responsibility are the same since last change (qualified by recency of last change and status of action: future, ongoing, completed).	JTF-6 monitoring
	Timeliness of action	Time desired for completion of action - Time taken to complete.	
Achievement	Outcome of mission	JTF-6 rating of DoD goal accomplishment.	JTF-6 after action report (AAR)
		DLEA & DLEA Hq rating of DLEA and DoD goal accomplishment.	DLEA AAR
		DoD Unit & Hq rating of DoD goal accomplishment.	DoD AAR
		(All ratings qualified by goal.)	
Resource Impact	Unit benefit	DoD Unit Hq rating (net gain, loss) (qualified by DLEA rating of DoD support).	DoD AAR DLEA & DoD AAR
Improvements	Procedural recommendations	Narrative description of recommended ways to improve interagency procedures.	

Implementation

The feasibility of the proposed measurement approach depends on several items. First JTF-SIX needs to verify or update the facts as presented here. Consensus between JTF-SIX and ARI needs to be reached about the assumptions, goals, and scope of this project. The concept hinges on the practicality of JTF-SIX adding reporting requirements to their standing operating procedures. The advantage of having a better set of measures will be to obtain lessons learned to improve the JTF-SIX operations.

Coordination will be required for ARI to gain a more complete understanding of the nature of JTF-SIX functions and procedures. With the appropriate coordination and support, ARI is willing to elaborate the measures and procedures for JTF-SIX collection and interpretation and to assist in transitioning the measures into use.

Working Paper

WP LVN-89-01

Comparison of Direct Manipulation and Form-fill Concepts for Unit Task Organization

Jon J. Fallesen
Army Research Institute

James P. Flanagan and Bruce J. Packard
Science Applications International Corporation

June 1989

Reviewed by:________________

Approved by:________________
STANLEY M. HALPIN
Chief, Fort Leavenworth
Field Unit

Cleared by:________________
ROBIN L. KEESEE
Director,
Systems Research Laboratory

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria, VA 22333-5600

Comparison of Direct Manipulation and Form-Fill Concepts for Unit Task Organization

The purpose of this report is to compare the maneuver control system (MCS) unit task organization change (UTOCHG) message with the task organization and status tool (TOAST) developed for the Army Research Institute's (ARI) tactical planning workstation.

Background

ARI evaluated a MCS new equipment training (NET) course for unit operators and trainers in September 1986 and made recommendations for improving training. ARI also conducted the training and mission oriented protective posture (MOPP) evaluation for the Operational Test and Evaluation Agency (OTEA) in the MCS follow-on test and evaluation (FOTE) I. The MOPP and operator assessments were done in garrison separate from the command field exercise (CFX) portion of the FOTE so objective, quantifiable data could be collected without disruption to staff operations. Report on the approach and findings were transmitted to the TRADOC Combined Arms Test Activity (TCATA) for documentation in their test report entitled, Maneuver Control System Follow on Test and Evaluation I (Coordinating draft test report, 9 July 1987).

Of the operator tasks which were sampled and tested in FOTE I the UTOCHG was the <u>message</u> type which had the most errors. (Failure to process/update the data base was the most frequent error type overall, leading to data never being entered into the data base.)

In addition to transferring these results to TCATA, the ARI FOTE results were provided to the CACDA NET team, the Chief of the Maneuver Proponency Branch, and briefed to the TRADOC System Manager MCS in June 1987. It was understood by ARI that a formal request would be made to conduct follow-on research to develop concepts to address the identified problems. No request was ever received from CACDA to perform the follow-on research.

Under ARI's research program of developing and evaluating staff enhancements, input was received from the Command and General Staff College (CGSC) and the Combined Arms Combat Development Activity (CACDA) indicating that the priority task for research and development was tactical course of action analysis (Description of Selected Army Staff Functions: Targets for Planning Aids, ARI Research Note 88-62). A tactical planning workstation was developed. Often referred to as the EDDIC workstation (Experimental Development, Demonstration and Integration Center), it has been demonstrated to

Activity (CATA), as well as representatives from government and industry. The EDDIC architecture consists of SUN 3/160 scientific workstations using X Windows--version 11, and unique ADA software program modules.

One of the tool enhancements that has been designed and prototyped is the Task Organization and Status Tool (TOAST). The tool was proposed originally by the EDDIC system development and maintenance contractor (Science Applications International, Corp.). Several design iterations were developed which proposed to use text based formats. A design goal was established to implement the tool using direct manipulation instead of text input to re-assign units. This goal was met with the current configuration of TOAST completed in January 1989. The design reflects capabilities for the intended application of supporting the staff planning functions of re-organizing forces during course of action development and analysis. Beyond its designed application for use in studies of course of action analysis, TOAST provides an operational prototype for examining potential improvement to the MCS unit task organization change (UTOCHG) message format.

TOAST Description

TOAST is an interactive aid that permits a user to review and make changes to a task organization of friendly units. TOAST uses a "tree structure" chart that reflects the current tactical situation, common in format to that used in FC 101-5-2 (Staff Officers Handbook) and CGSC ST 101-1 (Organizational and Tactical Reference Data for the Army in the Field). The user can point (with a mouse in the case of EDDIC, and a joystick in the case of MCS) at any unit and obtain status information relevant to the selected unit. Two levels of detail are available to the user when selecting status information. Either a detailed or summary report can be produced and displayed in tables or "mercedes" charts, similar to the formats specified for MCS version 11 (see Figure 1).

Any unit viewed on the task organization chart may be moved to another parent unit by simple mouse manipulation, requiring minimal interactions and time. Each movement of a unit to another parent results in automatic roll up of status information for both the gaining and losing parent. When moving units from one parent to another, the user may scroll the displayed organization chart and split the screen horizontally or vertically to tailor the view to the units being considered for change (see Figure 2). The selection of a mission for the unit being moved (attached, direct support, etc.) will determine the appropriate roll up of assets for selected units. The user has the option to display selected types of units (combat, combat support, combat service support), thereby reducing screen clutter and focusing only on vital information. The last change made to a task organization can be undone simply by pointing and clicking

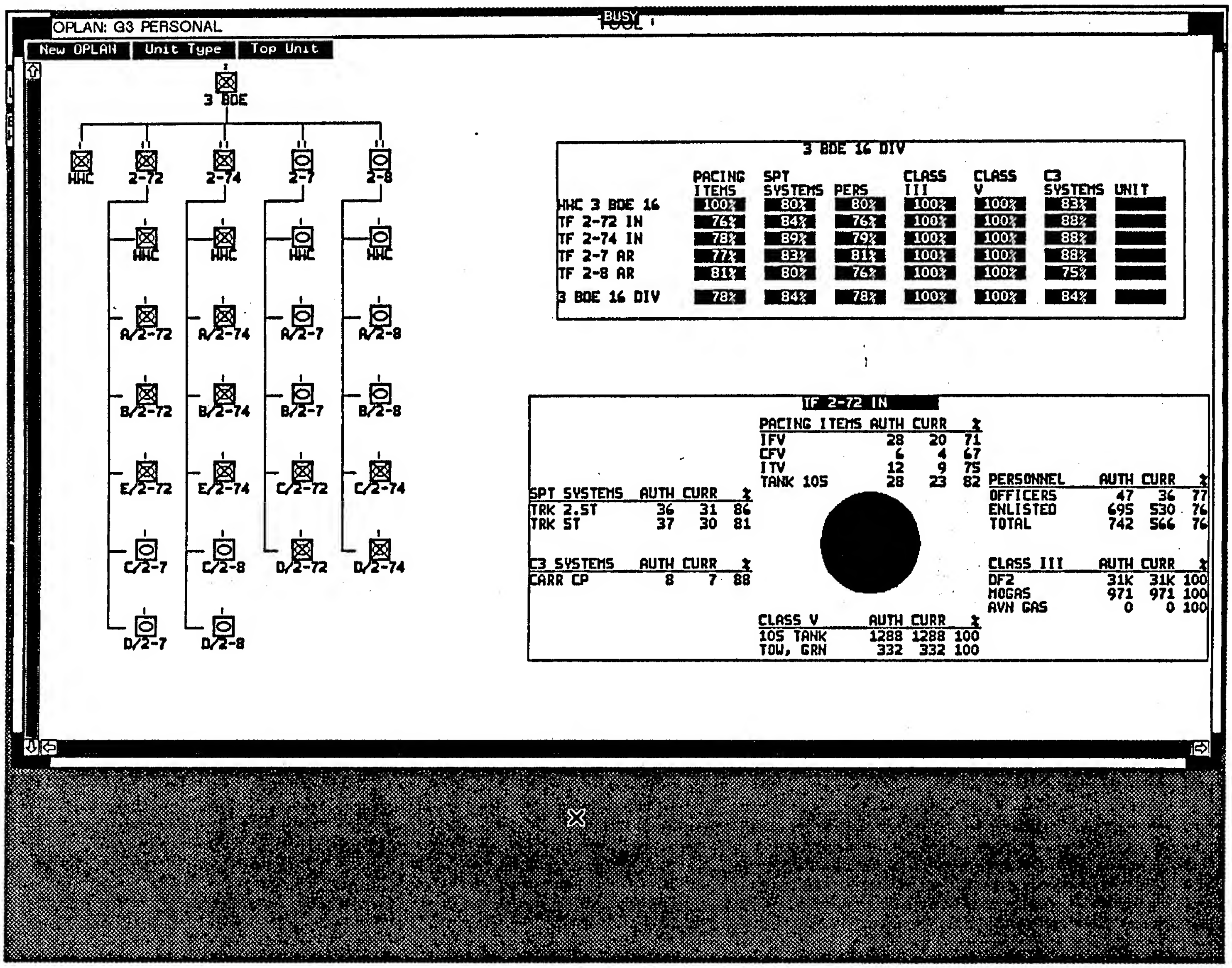

Figure 1. Task organization and status tool with detailed and summary information.

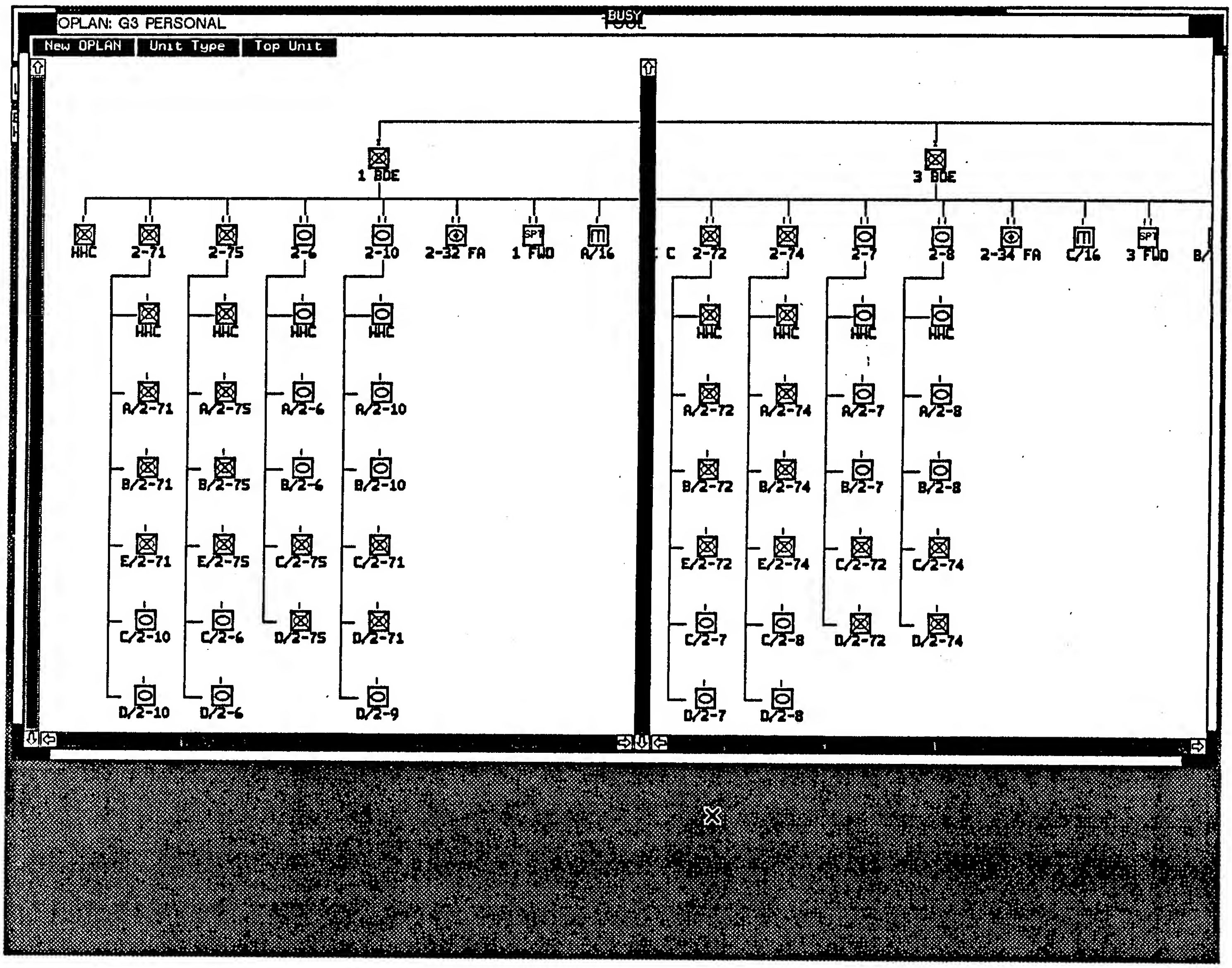

Figure 2. Task organizatin and status tool with vertically split screens.

the mouse on a special selection key for that purpose.

All operations are performed using the mouse in a "point and click" manner rather than form-fill and keyboard inputs used in other systems. The "point and click" technique requires minimal training and reduces the likelihood of making errors. The ease of manipulation also allows for more excursions and trials to achieve optimum organization structure.

The graphic portrayal of task organization presents users with a rapid, easily understood picture of the friendly force composition. The ease and flexibility of moving units from one parent to another will aid those officers who must array forces. The graphical presentation of unit organization and display of unit status can assist many staff tasks. Specific applications include:

Unit task organization change
Personnel status reports (by unit)
Command relationships/assignments
Allocation and mix of forces
Mission analysis
Orders development
Long range planning.

Also the current concept can be extended to assist the staff in developing the intelligence preparation of the battlefield. An organizational structure similar to TOAST could depict known enemy information and structure.

Results from MCS FOTE I on UTOCHG Message

In the MCS FOTE assessment twelve NET-trained operators were given the following written instruction

DTG 241100ZAPR87

3-78 MECH BN INF-M OF 1 BDE IS PLACED OPCON TO 2 BDE

UPDATE THE DATA BASE TO REFLECT THIS CHANGE IN TASK ORGANIZATION.

What should have been a straightforward task organization change resulted in 28 data base errors out of a possible 132, a 21 percent error rate. Data base errors included both missing data and incorrect data. (The "possible 132" is derived from 11 items, which were required in the data base resulting from the UTOCHG, times the 12 operators who were tested individually on the MCS tasks.) Additionally three of the twelve tested operators displayed a good deal of confusion and deliberation to perform the task, taking from 8 1/2 minutes to over 14. Times to perform the task were measured as the time from when the operator was given the written instruction to

update the data base until the PROCESS variable function key had been depressed. The average time was quite lengthy averaging 6 minutes and 45 seconds (with a standard deviation of about 3 minutes). The operator taking the longest time never accomplished the task with a satisfactory level of accuracy (i.e., more errors were introduced into the database than data updated) and used about 155 keystrokes. The operator taking the shortest time (3 minutes, 10 seconds) used a total of about 75 keystrokes.

Projections of Performance with TOAST

Estimates were made for similar types of measures on a comparable task using TOAST on the tactical planning workstation.

The sequence of events for accomplishing the data base change with TOAST includes the steps below. The steps may change depending on the specific task organization change being done.

1. Select the Tool window to open it (move mouse and click).
2. Position the window (move mouse and click).
3. Select Task Organization from the menu (move mouse to selection and click).
4. Select G3 Oplan version from a pop-up menu (move mouse to "done" and click).
5. Select unit to re-assign (move mouse to unit and click, may require scrolling).
6. Select re-assignment type from pop-up menu (move mouse to selection and click, also the option exists to get a unit summary or status report).
7. Select new parent unit (move mouse and click, the option exists to undo the change using a variable function mouse key).

Steps 2, 3, and 4 can be omitted by having opened the Task Organization tool prior to this sequence and saving it. When saved or closed from prior use it will appear as a Tool Window selection. Step 1 would be replaced by selecting the Task Organization window. The fastest time to complete the data base change using steps 1 through 7 is about 30 seconds. This represents the minimal time by several of the developers to complete a data base re-assignment of a unit.

An operator was given ten minutes of instruction on TOAST and then given the following direction:

2-75 Mech Bn of 1 Bde is attached to 2 Bde

Make this change in the task organization.

This operator was an ARI employe with some previous familiarization on the EDDIC tactical planning workstation and no previous experience on TOAST. He used computers only occasionally in the past and had

not used one for the last 2 months. Without any guidance this operator was able to complete the task organization change in 51 seconds.

Although the number of task organization changes for a re-organization is situation dependent, ten can be used as an example number of unit changes to illustrate a comparison between the TOAST concept and the UTOCHG message format. Extrapolation of the 51 second nominal figure for TOAST and the average time for MCS shows that ten changes could be made in 8 and half minutes with TOAST compared to over an hour with MCS.

Conclusion

This quick analysis shows that the current MCS version requires an excessive amount of time and number of steps to complete a task organization change. This was highlighted by data collected in FOTE I. An alternate way of performing task organization has been designed using direct manipulation ("point and click") with graphic organizational charts. This concept has been developed into a working prototype. Pilot data collection indicates that this approach, referred to as TOAST, has the potential to reduce training requirements while at the same time increasing speed and accuracy of operators' performance. The TOAST concepts should be given further consideration by combat developers for inclusion in MCS.

WORKING PAPER **LVN 92-01**

Army Command and Control Evaluation System (ACCES): A Brief Description

Stanley M. Halpin
Chief, Fort Leavenworth Field Unit

January 1992

Reviewed by: DAVID W. WITTER
Assistant Director, Manpower and Research Division

Approved by: ZITA M. SIMUTIS
Director, Manpower and Personnel Research Division

Cleared by: ZITA M. SIMUTIS
Director, Manpower and Personnel Research Division

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

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ACKNOWLEDGEMENTS

The ACCES methodology described in this paper has benefited greatly from the contributions of many people in the last five years.

Several key Army officers have provided not only support and encouragement, but also the critical feedback which helped to shape our vision of ACCES. MG Granrud, then Director of Command, Control, and Intelligence in the Combined Arms Combat Development Activity, was the first to recognize the potential of ACCES in support of systems' evaluations, and he provided extremely valuable encouragement and support during the early phases of this project. MG Stephenson,Commander of the Operational Test and Evaluation Command (OPTEC) directed his staff to work with us to realize that potential and apply ACCES during tests of the Army Tactical Command and Control System (ATCCS). MG Clark, then Director of the Battle Command Training Program (BCTP), challenged us to use ACCES to provide feedback to his training audiences, and provided us with invaluable opportunities to be included in the BCTP team. BG Ernst and COL Sturbois have continued that tradition during their respective tenures in BCTP.

Dr. Richard Hays and Mr. Rick Layton have been with ACCES through most of its development, first with Defense Systems Inc., and now with Evidence Based Research; without their scholarship, commitment, and creativity, the ACCES methodology today would be very different and very much more limited in its potential. Dr. Carol Girdler and Mr. Bill Ross, BDM Corporation, have made significant contributions to our efforts to move ACCES from the theoretical to the practical realms of Army C^2. Dr. Lloyd Crumley and, more recently, Dr. Douglas Spiegel, have served tirelessly as the ARI in-house ACCES "gurus".

The evolution of ACCES has relied heavily on feedback gained through field applications. MAJ Edward Sullivan and CPT Douglas Litavec were indispensable during their respective tenures as R&D Coordinators for the ARI Field Unit at Fort Leavenworth; their hard work alone kept several of the applications from becoming administrative and logistical nightmares, and their insightful evaluations of the methodology made the applications worthwhile.

Despite the important role played by the individuals listed above, and by the many others who worked to develop and apply the methodology, there would be no ACCES if it had not been for the support and encouragement of Dr. Robin Keesee, Director of ARI's Systems Research Laboratory through virtually the entire life of the project. He was the first to see the importance of both the scientific and the application issues, and he provided us continuing technical advice, moral support, and budgetary largess as we addressed those issues.

ARMY COMMAND AND CONTROL EVALUATION SYSTEM (ACCES): A BRIEF DESCRIPTION

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I. Overview

Introduction

This report provides an overview of the Army Command and Control Evaluation System (ACCES) theory and methodology. ACCES was initially developed by Defense Systems, Inc. (DSI) in the period October, 1986 to January, 1990 under the direction of the Fort Leavenworth, Kansas, Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). In April, 1990, ARI awarded a follow-up contract to Evidence Based Research, Inc. for specific required enhancements to the ACCES system. This report provides a description of ACCES Version 91.3, and is current as of the end of December, 1991. Continued refinement to the ACCES model of command and control, data collection methods, and data analysis procedures may be expected for the next several years.

Background

MACOM commanders and the Training and Doctrine Command (TRADOC), through the Battle Command Training Program and the Support to Exercise Program, provide frequent opportunities for brigade, division, and corps staffs to train in Command Post Exercises (CPXs) and Field Training Exercises (FTXs). The commanders and staffs are exposed to varying environments and situations and are given the opportunity to practice and hone their ability to function as effective command and control (C^2) systems. The Operational Test and Evaluation Command (OPTEC) is frequently called on to evaluate C^2 materiel systems. Less formal system evaluations are conducted throughout C^2 systems' life-cycles by agencies such as the Future Battle Laboratory, Fort Leavenworth, Kansas, and the ATCCS Experimentation Site, Fort Lewis, Washington.

Both training and test and evaluation exercises require some measure(s) of system performance. In the training environment, exercises provide little benefit unless participants are provided feedback on their performance. In the test and evaluation environment, measures and criteria of system success or failure are obviously critical. However, while measures have been developed which address the efficiency of selected aspects of C^2 performance (e.g., throughput rates for certain types of messages within certain communication systems), there is no accepted overall measure of C^2 effectiveness (See Crumley, 1989 for a complete review of C^2 measurement alternatives.)

Under the sponsorship of the Combined Arms Command – Combat Development (CAC–CD), ARI has taken steps to address this need for C^2 measurement through the development of ACCES, a measurement system to evaluate the effectiveness of C^2 at various levels. ACCES differs from traditional force effectiveness measures (e.g., force loss ratios) which address the headquarters primarily in terms of its subordinates' efforts. In contrast, ACCES is based on the premise that C^2 effectiveness may be defined as the effectiveness of a headquarters staff; in this view, C^2 effectiveness measurement requires an understanding of the processes that are performed by the staff to facilitate the performance of subordinate elements. Thus, we need a means to measure quantitatively how well the critical staff processes are performed.

The ACCES methodology has been evolving over the last several years. During that period ACCES has provided the framework for data collection and analysis at twelve division training exercises and one corps training exercise. During or after many of these exercises the unit commanders and their principal staff were provided feedback on their C^2 effectiveness based on the ACCES observations and measures. While no one will claim that ACCES is the ultimate system which captures all aspects of C^2 effectiveness, there has been general agreement that the ACCES approach is providing valuable evaluative and diagnostic information in support of C^2 training. Current follow-on developmental efforts are underway to modify ACCES measures in order to bring them more in line with doctrinal tasks and standards and to refine the data collection and analysis procedures in order to provide more accurate and complete feedback during and after a several day training exercise. A cooperative effort with OPTEC is exploring the application of ACCES to the evaluation of the Army Tactical Command and Control System (ATCCS).

Section II of this paper contains an expanded description of the ACCES model, procedures, and measures.

ACCES in a Training environment

Despite the word "evaluation" in the label "Army Command and Control Evaluation System", it must be emphasized that ACCES does not provide a rating of C^2 effectiveness; i.e., ACCES does not grade a division HQ as having passed or failed against some set of criteria. Rather, ACCES provides indicators of C^2 effectiveness. It is precisely these indicators which are of value to a commander during and after a CPX. A major strength of the Army's Battle Command Training Program (BCTP) is the quality and quantity of feedback provided to the training audience by BCTP personnel. ACCES indicators would provide additional detail and a different perspective on C^2 effectiveness than currently provided by BCTP. Unfortunately, one of the strengths of ACCES, the ability to draw from behaviors occuring in different locations at different times, also is a weakness of the system when applied in a training environment with its requirement for rapid feedback. A major focus of current ACCES development efforts is the exploration of means to simplify ACCES data collection and analysis procedures and techniques so as to reduce the time required to provide substantive feedback to the unit being observed.

ACCES in a Test and Evaluation environment

In the typical test of a materiel system, the goal is to evaluate the system against system requirements which specify performance objectives or standards. However, there are few if any accepted performance objectives or standards for C^2 systems. We believe that the key to C^2 test and evaluation is the use of a stable baseline of system performance data which can be used for comparison. Rather than defining *a priori* standards of "successful" C^2 system performance, we argue that the most appropriate evaluation strategy is one which compares the new system to the old. ACCES measures are targeted to critical C^2 system performance characteristics, and a collection of ACCES measures across several units can provide a stable baseline for such comparisons.

There are at least two types of C^2 system evaluation which could utilize ACCES. One target would be the examination of the effectiveness of the overall C^2 system in a test unit which is trying out a change in the C^2 system itself (e.g., a unit using a new command post structure,

or one using a new computer-based system). A second target would be the examination of the effectiveness of the overall C^2 system in a test unit which is trying out some change in one of the supporting systems. The argument here is that while a sub-system like Intelligence or Fire Support should be evaluated in its own right to determine whether it is reliable, usable, etc., it is also necessary to determine whether that subsystem provides any value-added to the overall C^2 system in the context of the overall Army Tactical Command and Control System (ATCCS). In both types of C^2 test and evaluation, the use of a stable ACCES baseline can be used for comparison to establish the incremental changes in C^2 system performance during the test.

The continued evolution of ACCES has made it difficult to establish a stable baseline. The ACCES (version 91.3) which is described in this paper is the latest in a series stretching back five years. Each of the "versions" of ACCES has differed in some significant respects from prior and subsequent versions; we have evolved the ACCES model of command and control, we have changed the focus of our measurement, and we have changed our data collector training procedures (and hence have changed the way data are collected and analyzed). (See Appendix A for a description of the evolution of ACCES measures from the precursor HEAT measures, through the 1989 version of ACCES to ACCES version 91.2.) These improvements have been at the expense of creating a stable baseline of similar data elements similarly collected under similar conditions from similar units. However, some communalities can be identified, and two reports currently in preparation will summarize, respectively, lessons learned in six early ACCES applications and in four 1991 applications (using ACCES versions 91.1 and 91.2). A new project of the Fort Leavenworth Field Unit beginning in 1992 will examine in more detail the steps which the Army needs to take in order to create a stable database of C^2 performance data which can be used not only for test and evaluation comparisons, but also as a basis for training feedback and for identification and analysis of doctrinal deficiencies and lessons learned.

II. Army Command and Control Evaluation System

Example Scenario

To provide a context for describing the elements of ACCES, this section of the paper provides a sketch of a typical scenario for a five-day division-level training exercise. In such an exercise, the division headquarters elements and the headquarters of the major subordinate commands would be in command-post mock-ups, or deployed to a field training site. They would use their organic communications equipment to communicate with subordinate elements represented by personnel interacting with a simulation such as the Corps Battle Simulation (CBS; also known as JESS) or First Battle-BC. Information on the battle being played within the simulation flows from lower echelons to brigade and division staffs; information, directives, and requests for information flow from the headquarters to the lower echelons. The corps headquarters and adjacent division headquarters are represented by small groups of personnel who also have access to the simulation.

In our "typical" scenario, let us assume that the Corps has directed the Division to protect the northern flank of the Corps for a seven-day period as the Corps prepares for and executes a counter-attack to the east. Some time before the beginning of the exercise, the Division Commander chooses an aggressive strategy which involves moving his maneuver elements rapidly to the north to engage the expected Enemy Force in a series of meeting engagements, followed by occupation of strong points and a hasty defense. The Division Commander further intends to launch counter-attacks as appropriate rather than establishing prepared defenses at the strong points. Based on this concept of operation, the Division operational order (OPORD) is prepared which details mission, task organization, and boundaries for the elements of the Division. Shortly after the beginning of the exercise, a fragmentary order (FRAGO) is issued with additional information on the schedule for the 1st Brigade to secure river crossings and support the 2nd and 3rd Brigades as they pass through. As the fight develops over the next three days, several FRAGOs are issued: a) adjusting schedules due to unexpected early success; b) adjusting resource allocation; c) adjusting boundaries as the units set for a hasty defense; d) changing mission ("withdraw and reconstitute"); and e) changing task organization. By day three it becomes clear that the Corps no longer has the resources to support the Division's aggressive posture, and a Corps FRAGO adjusts the Division's rear boundary, allowing the Division more depth in which to defend against the continuing series of attacks by fresh Enemy Forces. By day five the Division has expended roughly 70% of its resources (including its original resources and those provided by Corps during the exercise), is still defending within its assigned sector, and apparently will be able to accomplish the original mission of protecting the Corps' northern flank.

Neither ACCES nor any other known methodology can evaluate the Division Commander's basic concept of operations in this scenario. For example, how could we determine whether the unit's success was "worth" the expenditure of personnel, equipment, and other resources? How could we determine what would have or could have or should have occurred in the execution of a different concept? Analytical wargaming techniques may be able to provide some clues to the relative merits of alternative concepts given identical start-points, but the typical training scenario, like the real world, is too complex to allow sufficient replications in sufficient detail. Furthermore, we must keep in mind that we are observing <u>training</u> exercises. The commander may select a particular course of action suspecting that it may be relatively ineffective tactically

compared to a more conservative approach, but choosing to challenge his staff and subordinate commanders with novel problems and circumstances. Rather than subjectively examining the commander or the "quality" of his decisions, ACCES objectively examines the C^2 **process** and the **outcome** of that process (i.e., plans and directives).

Many of the questions which would come to mind in considering staff performance in our example above are quite straightforward. Who was in a position to obtain information about the evolving enemy situation? Who was keeping tabs on friendly unit status? Did those individuals or staff sections share their knowledge with one another? Was the information they obtained timely? Accurate? Complete? Was the information used to make reasonable projections to possible futures? Were the information and projections fully presented to appropriate decision makers? Once decisions were made, were subsequent plans and orders based on timely, accurate, and complete information? Were the plans and orders consistent with the decision? Were they coordinated with all necessary staff sections, and with higher, lower, and adjacent commands to anticipate and avoid problems in execution? The challenge in attempting to **measure** C^2 performance is to answer all of these questions, and others, within a coherent framework so that the answers provide meaningful insights into the C^2 process. ACCES provides a framework for addressing these questions through a **model** of the C^2 process, **measures** of the process which are derived from that model, and **analysis techniques** which guide a systematic process of deriving quantitative measures from observational data.

The focus of ACCES is on the observable outcome of C^2 processes; the methods and techniques employed are of secondary interest, and then only to the extent that they may provide clues to identify problems that may be affecting the quality or timeliness of the outcomes. For example, a staff might use one or more techniques to insure that the order they develop is consistent with the guidance provided by the decision maker. These techniques include: a) effective note taking during discussions with the decision maker; b) checking with others who were present when the guidance was given; c) incorporating the decision maker into the discussions during the planning and orders-development process; d) informal or formal "brief backs" to the decision maker; or e) a combination of these techniques. There is no ACCES measure based on observing which, if any, of these techniques is used. Rather, there is an ACCES measure of the outcome of the process, in this case the match between the guidance from the decision maker and the order issued.

ACCES model of C^2

As we begin to examine the conceptual model of C^2 which provides the context for other elements of ACCES, it is important to define what we include in our use of the term "C^2." We view command and control as an observable behavioral process. People command, and people control. The headquarters elements of a unit (e.g., the division Main Command Post, brigade Tactical Command Post, etc.) are comprised of people whose primary function is to provide the command and control outputs which serve to structure and guide the actions of subordinate units. Those people work within constraints established by tradition, doctrine, training, and experience. They are supported by, and further constrained by, various C^2 systems which function to gather, manipulate, and transmit information within and among headquarters. The ACCES conceptual model of C^2 assumes that the headquarters of a unit, the groups of people who do command and control combined with their supporting information systems, may themselves be viewed as a "system". This headquarters "system", i.e. the overall C^2 system, establishes goals and objectives for subordinate units (based on

goals and objectives provided by the senior unit), within an environment characterized by a great deal of uncertainty. This overall C^2 system actively obtains information about the environment, reviews that information to determine whether the goals and objectives are achievable, and aperiodically generates new outputs in the form of new or revised goals and objectives for subordinate units. In simplest terms this "adaptive control system" seeks to achieve a balance between the desired and actual state within its environment by monitoring the state of the environment and making any necessary changes in the actions of the elements it controls.

The overall effectiveness of the C^2 system, the headquarters of a unit, can be judged by the viability of their outputs, and the critical outputs are the "plans" and related directives which establish the goals and objectives for subordinate units. Good plans can be executed without need for modification beyond the contingencies built into them and remain in effect throughout their intended life. Alternatively, a headquarters may find that its plans (in decreasing order of effectiveness):

- require minor adjustment in the course of their execution, without change to the basic plan;
- require execution of a contingency, significantly different from the intended course of action, but provided for in the initial plan; or
- require cancellation and issuance of an entire new plan.

This conceptual model of C^2 was used to guide the development of measures of the C^2 process within the progenitor of ACCES, the Headquarters Effectiveness Assessment Tool (HEAT); see Crumley, 1990, for a detailed discussion of HEAT and alternative models of C^2. Measures were developed by asking what observables could provide some insight on the functioning of such an adaptive control system. The focus in HEAT and, more recently, in ACCES has been on the primary C^2 outputs of the headquarters, plans and directives, and on the information which provides the headquarters with an understanding of the environment.

The overall ACCES measures of C^2 system effectiveness address primarily the extent to which plans remain in effect for their intended period, without the need for unanticipated changes in the plan. "Effective" headquarters are those which: a) develop stable plans (presumably based on very accurate and insightful analyses of current and likely future status); b) issue directives concerning missions, assets, schedules, and boundaries which are successfully executed without change; and/or c) issue directives which permit flexible responses in rapidly developing situations (contingency planning).

ACCES also provides diagnostic measures of the quality of processes by which C^2 system functions are performed. An exercise timeline and its associated C^2 cycles are used in ACCES as the framework to describe the information transformation processes engaged in by a staff and the decision maker, from the acquisition of data to the issuance of plans and directives. ACCES also looks at the performance of individual functional cells and the interactions between the cells. The general approach, as illustrated in Figure 1, is built around the following concepts:

- The "environment" within which this adaptive coping process is attempting to maintain control consists of subordinate and higher headquarters, plus the elements of METT-T (Mission, Enemy, Troops, Terrain, and Time).

- The staff is understood to engage in a number of actions in order to support decision

making and its implementation:

- Collecting information through monitoring the environment and receiving reports,
- Synthesizing information,
- Developing and evaluating alternatives,
- Reviewing recommended courses of action,
- Planning implementation,
- Reporting,
- Coordinating,
- Inquiring (seeking information), and
- Disseminating information in messages and reports

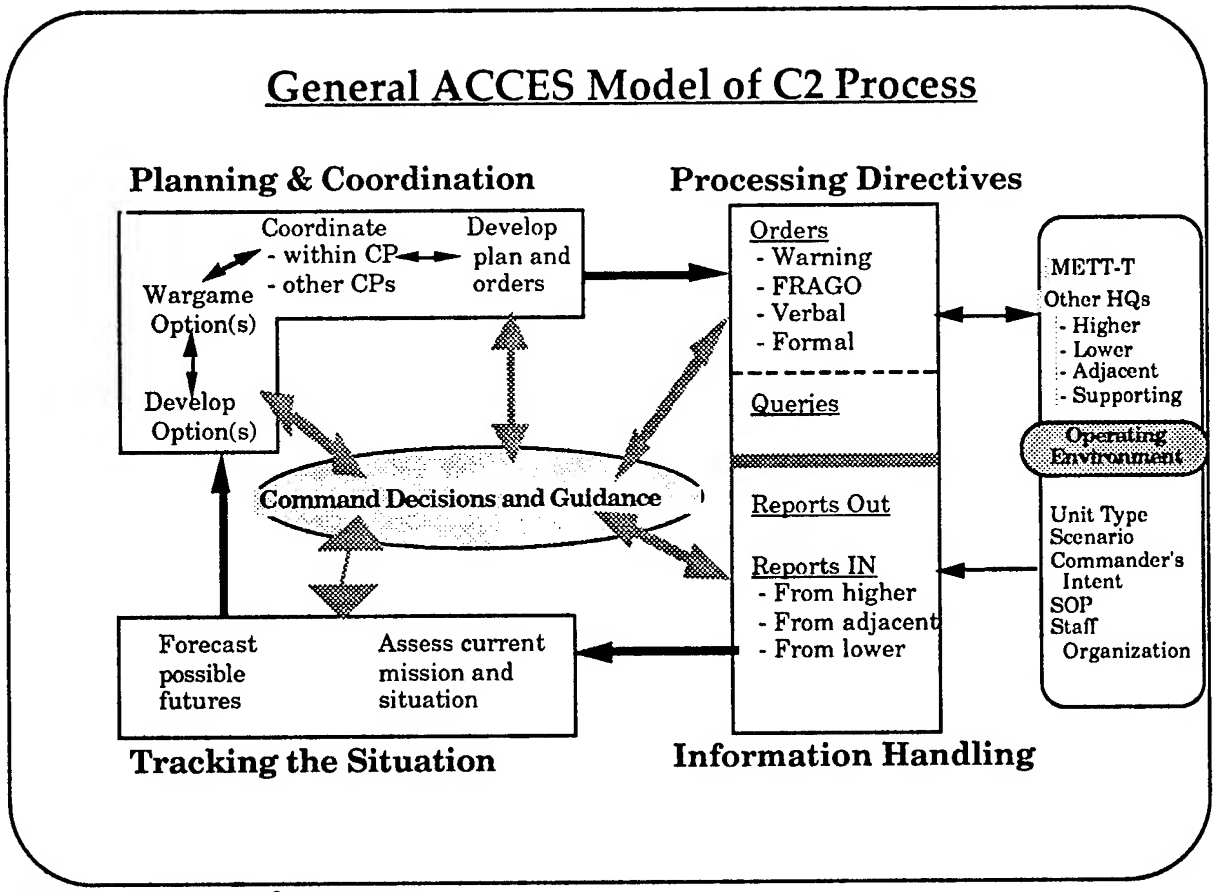


Figure 1. ACCES C^2 Processes

- A full C^2 cycle in ACCES begins with the receipt of information about the environment, and continues with evaluation of the status of the situation *vis a vis* the current plan, recognition of a need for change(s) in the plan, exploration of alternatives, a decision on change(s), and detailed plan development, and concludes with preparation and issuance of a directive.

- ACCES C^2 cycles will not always involve all of the above steps; for example, the exploration of alternatives and detailed plan development may both be by-passed under

conditions of very high stress (severe time pressure while trying to address a crisis) or very low stress (confirmation that it is time to execute a pre-planned branch or sequel to the current plan).

- The actions of the staff, outlined above, yield a series of products which are <u>observable</u> elements of the ACCES C^2 cycles:
  - Information about the environment,
  - An initial understanding of the situation,
  - The estimate of the situation, including a set of alternative actions, their expected results, and consequent recommendations,
  - Decisions by the Commander (or in some cases the staff, acting for the Commander),
  - Inquiries (for information),
  - Reports that inform others, including answers to incoming queries,
  - Command guidance, and
  - Plans and directives.

The concepts upon which ACCES is built assume that effective staffs look ahead in time and develop plans that are robust (i.e., plans that will support mission accomplishment despite changes in the elements of METT-T). ACCES v. 91-3 (as shown in Table 1) includes 49 primary measures of performance; of these, 6 of the measures deal with the planning process as a whole and the remainder are descriptive measures which focus on the process steps separately. An additional 178 subordinate measures provide a rich source of additional diagnostic information for an analyst examining a particular exercise. Two additional categories of measures are also developed in ACCES. Table 2 lists the six descriptive "measures" of the decision context: for example, for each decision recorded, who made the decision? What unit(s) is/are affected? Appendix B lists 17 primary and 18 subordinate descriptive "measures" of the exercise and scenario; these elements of ACCES will come into use as we begin to aggregate and compare data across different exercises.

TABLE 1. PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
GENERAL MEASURES (Overall planning process)			
G 1.0	Plan Duration	Time from implementation of plan to time it is changed in some substantive way or completed.	4 – Duration of each of the four major plan elements: Mission; Task Organization;Boundary; and Schedule.
G 2.0	Plan Stability	A percentage based on time: Plan Duration (G 1.0) *vs.* the intended life of the plan.	4 – Stability of each of the 4 major plan elements: Mission; Task...
G 3.0	Plan Execution* * v. 91-2: Planning Effectiveness	A percentage based on the number of all major plan elements which are completed within original contingencies, indicating sufficient leeway for adaptation to battlefield conditions.	0 – However, note that each of the 4 major plan elements could be called out separately when summarizing across time.
G 4.0	Planning Success* * v. 91-2: Plan Success	A percentage based on the number of plans which are completed without change ("dominant") or within original contingencies ("adaptive") compared to the total number of plans.	0 – However, requires computation of: total number of plans; number of plans which were "dominant" ; number of plans which were "adaptive."
G 5.0	Planning Initiative	The percentage of all plans which are proactive (assume any changes in the battlefield will be under own force's control) or contingent. (anticipate some change which will be handled by established contingencies) rather than "reactive (assume own force has little or no control over possible changes in the battlefield).	0 – However, requires computation of: number of plans which were "proactive"; number of plans which were "contingent".
G 6.0	Planning Cycle Time	Time from awareness of need to time directive is issued.	3 – Planning cycle time under each of three conditions: Low; Moderate; or High "stress". The degree of planning stress is a function of the degree of success of the prior plan.

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
INCOMING INFORMATION HANDLING (Periodic Reports and Spot Reports)			
I 1.0* * New Measure: Integration of I 1.1 & I 1.2 from v. 91-2	Punctuality of incoming information	The time of receipt of Friendly Status Reports (FSRs) and Enemy Intelligence Summaries (INTSUMs) is compared to the unit's SOP for report times.	12 – 6 each for FSRs and INTSUMs, detailing numbers, percentages, and timing of reports received.
I 2.0* * New Measure Integration of I 2.1& I 2.2 from v. 91-2	Completeness of incoming information	The percentage of FSR and INTSUM information elements reported on, compared to SOP-defined mandatory elements.	10 – 5 each for FSRs and INTSUMs detailing percentage of reports containing various information elements (location, status, etc.).
I 3.0* * New Measure Integration of I 3.1 & I 3.2 from v. 91-2	Accuracy of incoming information	The percentage of accurate FSR and INTSUM information elements, compared to "ground-truth."	10 – 5 each for FSRs and INTSUMs detailing percentage accuracy and degree of error.
I 4.0* * New Measure Integration of I 4.1 & I 4.2 from v. 91-2	Recency* of incoming information * v. 91.2: the term "currency" was used rather then "recency"	The median age of the oldest element of information in FSRs and INTSUMs .	2 - 1 each for FSRs and INTSUMs
I 5.0* * New Measure Integration of I 5.1 & I 5.2 from v 91-2	Clarity of incoming information* * v. 91.2: "Requests for Information"	The percentage of report elements in FSRs and INTSUMs which do not lead to requests for confirmation or clarification.	12 – 6 each for FSRs and INTSUMs, detailing the percentage of various elements of the reports which lead to confirmation/clarification follow-up. (These include I 6.1 and I 6.2 from v. 91-2.)
I 6.0* * New Measure Integration of I 8.1 & I 8.2 from v. 91-2	Spot Report accuracy	Parallel to I 3.0 The focus here is on Friendly and Enemy Spot Reports rather than the periodic reports considered in I 3.0.	10 – 5 each for FSRs and INTSUMs detailing percentage accuracy and degree of error.
I 7.0 * New Measure Integration of I 7.11 & I 7.21 from v. 91-2	Spot Report recency* * v. 91.2: the term "currency" was used rather then "recency"	Parallel to I 4.0 The focus here is on Friendly and Enemy Spot Reports rather than the periodic reports considered in I 4.0.	6 – 3 each for FSRs and INTSUMs detailing time elements in the Spot Report process.

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
INCOMING INFORMATION HANDLING (Periodic Reports and Spot Reports) (cont.)			
I 8.0* * I 9.2 from v. 91-2	Weather and Terrain report accuracy	Percentage of report elements which are accurate These information elements are considered "accurate" unless the impact of weather or terrain on operations is different than was forecast.	0
I 9.0* * I 9.11 from v. 91-2	Weather and Terrain report recency* * v. 91.2: the term "currency" was used rather then "recency"	The age of the information in Weather and Terrain reports.	3 – Timing factors in the reporting process.
I 10.0	Information impact on plans* * v. 91.2: "Report impact on plans"	The percentage of plan changes which are <u>not</u> due to problems in incoming information accuracy, currency, etc. Includes both spot reports and periodic status reports.	0
TRACKING THE SITUATION (Friendly and Enemy Force Situation Assessments)			
T 1.0* * New Measure Integration of T 1.1 & T 1.2 from v. 91-2	Completeness of Situation assessments	The percentage of possible information elements discussed during <u>formal</u> Situation Assessments (SAs) (e.g., during command update or shift-change briefings). Current doctrine calls for six elements of Friendly information and five elements of Enemy information.	11 – 6 related to Friendly Situation and 5 related to Enemy Situation.
T 2.0* * New Measure Integration of T 2.1 & T 2.2 from v. 91-2	Accuracy of SA's	The percentage of SAs (formal <u>and</u> informal) which contain no incorrect assessments.	8 – 4 each for Friendly and Enemy assessments, detailing the "degree" of accuracy.
T 3.0	Median time span of assessments	The time from the assessment (formal <u>and</u> informal) to the end of the time period mentioned; e.g., "they will go on the offensive within 18–24 hours..." reflects a 24 hour span.	2* – One each for the time span of Friendly and Enemy assessments. * New measures; the subordinate measures were not previously detailed separately.
T 4.0	Assessment impact on plans	The percentage of plan changes which are <u>not</u> due to problems in situation assessment.	

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
OUTGOING INFORMATION HANDLING (Periodic Reports and Spot Reports)			
O 1.0* * New Measure Integration of O 1.11 & O 1.21 from v. 91-2	Punctuality of outgoing information	The time of transmission of Friendly Status Reports (FSRs) and Enemy Intelligence Summaries (INTSUMs) is compared to the unit's SOP for report times.. The measure is the percentage of reports sent early or on time.	12 – 6 each for FSRs and INTSUMs, detailing numbers, percentages, and timing of reports sent.
O 2.0* * New Measure Integration of O 2.1 & O 2.2 from v. 91-2	Completeness of outgoing information	The percentage of FSR and INTSUM information elements reported on, compared to SOP-defined mandatory elements.	10 – 5 each for FSRs and INTSUMs detailing percentage of reports containing various information elements (location, status, etc.).
O 3.0* * New Measure Integration of O 3.1 & O 3.2 from v. 91-2	Accuracy of outgoing information	The percentage of accurate FSR and INTSUM information elements when compared to "ground-truth."	10 – 5 each for FSRs and INTSUM's detailing percentage accuracy and degree of error.
O 4.0* * New Measure Integration of O 4.1 & O 4.2 from v. 91-2	Recency of outgoing information	The median age of the oldest element of information in FSRs and INTSUM's.	2 - 1 each for FSRs and INTSUM's
O 5.0* * New Measure Integration of O 5.1 & O 5.2 from v. 91-2	Clarity of outgoing information	The percentage of report elements in FSRs and INTSUMs which do not lead to requests for confirmation or clarification.	4 – 1 each for FSRs and INTSUMs based on a percentage of <u>elements</u> and 1 each based on the percentage of <u>reports</u> which required no clarification.
O 6.0* * New Measure Integration of O 8.1 & O 8.2 from v. 91-2	Spot Report accuracy	Parallel to O 3.0 The focus here is on Friendly and Enemy Spot Reports rather than the periodic reports considered in O 3.0.	10 – 5 each for FSRs and INTSUM's detailing percentage accuracy and degree of error.
O 7.0* * New Measure Integration of O 7.11 & O 7.21 from v. 91-2	Spot Report recency	Parallel to O 4.0 The focus here is on Friendly and Enemy Spot Reports rather than the periodic reports considered in O 4.0.	8 – 4 each for FSRs and INTSUM's detailing locus of any time delays.
~~O 8.0~~	~~(Deleted)~~		

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
INFORMATION COORDINATION* (within and between CP's) * Previously labeled "Information Congruence".			
IC 1.0	Agreement within CPs on Situation Assessments* *Slight name change.	Of all "paired" Situation Assessments (SAs), i.e., those on a similar issue at roughly the same time, the percentage where different CP cells within a CP are in agreement.	2 – 1 each for SAs of friendly and enemy forces.
IC 2.0	Agreement between CPs on SAs* *Slight name change.	Parallel to IC 1.0, with the focus here on the agreement between different CPs (TAC, MAIN, REAR and BDE).	2 – 1 each for SAs of friendly and enemy forces.
IC 3.0* * IC 3.1 in v. 91-2	Coordination delays within CPs* *Slight name change.	The time between recognition of the need for coordination and the time an issue is resolved. NOTE that "coordination" is not information seeking, but rather is the request for substantive comment on, or input to, a plan or SA.	4 – Detailing number of instances and their timing.
IC 4.0* * IC 4.1 in v. 91-2	Coordination delays between CPs* *Slight name change.	Parallel to IC 3.0, with the focus here on coordination delays between different CPs (TAC, MAIN, REAR, and BDE).	4 – Detailing number of instances and their timing.
IC 5.0* *New measure	Consistency of directives within a CP	The percentage of directives issued which do not conflict with other directives issued from the same CP.	0
IC 6.0* *Was IC 5.0 in v. 91-2	Consistency of directives across CPs	The percentage of directives issued which do not conflict with the guidance from a higher HQ or the primary CP.	0
IC 7.0* *Was IC 6.0 in v. 91-2	Coordination impact on plan	The percentage of plan changes which are not due to problems in coordination.	0

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
COURSE OF ACTION ANALYSES* * Previously labeled "PC: Predict Courses of Action."			
COA 1.0* *PC 1.0 in v. 91-2	Number of staff participants.	The median number of staff members actively participating during COA Analyses.	0
COA 2.0* *PC 2.0 in v. 91-2	Variety of staff participants	The median number of staff sections represented during COA Analyses.	0
COA 3.0* *PC 3.0 in v. 91-2	Number of COA's	The median number of COA's explicitly considered during COA Analyses.	0
COA 4.0* *PC 4.0 in v. 91-2	Completeness of COA Analyses	The percentage of COA Analyses which included explicit discussion of <u>all</u> of the following: predictions of enemy reactions; likely degree of mission accomplishment; residual capacity of friendly units; residual capacity of enemy units.	4 – 1 for each of the four elements of analysis listed in the definition.
COA 5.0* *PC 5.0 in v. 91-2	Accuracy of COA Analyses	The percentage of "correct" projections of likely futures. Note that many analyses and projections cannot be assessed. For example, a statement that "If we bring all of our artillery to bear, we can slow down their advance by at least a couple of hours" cannot be assessed as correct <u>or</u> incorrect if the unit never "brings all of their artillery to bear." In some earlier versions of ACCES, such projections were labeled "not incorrect" and were included in the numerator and denominator of this calculation; here they are excluded from the calculation.	3 – Total projections recorded; percentage incorrect; percentage which cannot be assessed.
COA 6.0* *PC 6.0 in v. 91-2	Median time span of COA analyses	This measure parallels T 3.0. T 3.0 addresses the time span of situation assessments ("This is what is happening and is likely to happen"), while COA 6.0 addresses the time span of "what if" analyses during development of a plan.	0
COA 7.0* *PC 7.0 in v. 91-2	COA Impact on Planning	The percentage of plan changes which are <u>not</u> due to problems in COA analyses.	0

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
PREPARATION OF DIRECTIVES* *Note that COA analyses and the preparation of directives may be occurring simultaneously, and may involve many of the same people. Discussions which serve both purposes are counted in both sets of measures.			
PD 1.0	Number of staff participants.	The median number of staff members actively participating during preparation of directives.	0
PD 2.0	Variety of staff participants	The median number of staff sections represented during preparation of directives.	0
PD 3.0	Directive preparation time	The median time interval between a decision and the issuance of the implementing directive.	1* – Time interval between the decision and issuance of a warning order. * PD 4.0 in v. 91-2
PD 4.0* *PD 5.0 in v. 91-2	Time span of directives	The time span of a directive is based directly on the directive. For example, "On order, move to position xxxyyy and prevent enemy penetration of your sector for 24 hours" has a 24 hour time span. Many directives neglect start time, end time, or both, and cannot be assessed.	1* – Percentage of directives which identify a time span. * New measure
PD 5.0* *PD 6.0 in v. 91-2	Directive match with decision* *Previously labeled "Match with Commander's Intent".	The percentage of directive elements which match guidance received. The decision maker's decision with respect to mission, task organization schedule, and boundaries (as stated during initial guidance or follow-up discussions) are compared to the elements of the directive(s) issued.	0
PD 6.0* PD 7.0 in v. 91-2	Clarity of directives	The percentage of directives which do not require clarification by the issuing HQ.	0
PD 7.0* *PD 8.0 in v. 91-2	Lead-time for subordinate units' planning	The median time from receipt of a directive by a subordinate command to the time the first element of the directive is to be executed.	3*– A parallel measure of lead time provided by warning orders; the ratio of subordinates' lead time (PD 7.0) compared to the HQ planning cycle time (G 6.0); and a similar ratio for warning order lead time. *Includes PD 9.0 and 9.1 from v. 91-2.

TABLE 1 (cont.). PRIMARY ACCES MEASURES – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
PREPARATION OF DIRECTIVES (cont.)			
PD 8.0* *New measure.	Directive impact on plans	The percentage of plan changes not due to problems in directives* * Example: inadequate lead time for subordinates may prevent execution of a synchronized plan and require a new FRAGO.	1 – Percentage of directives fully implemented at intended time.* *PD 10.0 in v. 91-2
TOTALS: 49 Primary Measures			178 Subordinate Measures

TABLE 2 ACCES MEASURES OF DECISION CONTEXT – v. 91-3

NUMBER	TITLE	Brief Definition	Subordinate Measures
DECISION CONTEXT Labeled "Decision Control" in ACCES v. 91-2.			
DC 1.0	Decision maker	Position of the person making a given decision. Could include Commander, a subordinate in the commander's name, ADC(S) or ADC(M), COS, G3/S3, etc.	0
DC 2.0	Affected units	Listing of subordinate units affected by the decision to change an element of the plan.	0
DC 3.0	Decision focus	Listing of the element(s) of a plan affected by a given decision. Could include mission, task organization, schedule, etc.	0
DC 4.0	Contingency	Did a given decision involve activation of a previously planned contingency?	0
DC 5.0	Decision time	Time at which a decision was made.	0
DC 6.0	Type of operation	Identification of the type of operation affected by the decision. Categories of operations are taken from ARTEP 71-100-MTP.	0

Application of ACCES

The application of ACCES comprises five stages:

- Prior coordination with the unit and "customization" of ACCES procedures and measures if required;
- Obtaining and training data collectors;
- Data collection;
- Data analysis; and
- Report preparation

Each of these stages will be discussed in turn.

Prior Coordination and Customization. The key to ACCES measures is information exchange within and between C^2 elements. The ACCES model of command and control implies that an effective staff :

a. knows about and understands the meaning of the tactical situation ("seeing the battle");

b. shares that information and knowledge with other elements of the staff, with the commander, and with higher, lower, and adjacent units ;

c. uses that information and knowledge in conjunction with the commander's guidance to develop plans ("planning" and "wargaming");

d. provides the necessary information to the commander to allow him to make an informed decision on the preferred course of action;

e. creates and communicates operational orders (OPORDs) or fragmentary orders (FRAGOs) which convey to subordinate commanders an unambiguous statement of the commander's intent and guidance, particularly with respect to mission, assets, boundaries, and schedule.

ACCES can track and assess all of these steps, but only if the information being captured, shared, and used is noted by an ACCES data collector or is obtained through other means. It is straightforward to assess the timeliness, completeness, and accuracy of the "see the battle" staff processes if data collectors note what information is available within a given staff element and what discussions occur, and if there is a "ground truth" available for comparison purposes. However, the data collectors can never hope to obtain more than a sample of all information available and being discussed at a given location; furthermore, there are obvious practical limits on the number of CP elements which can be observed and on the number of observers within a given location. It is therefore necessary to focus the observers' attention on the relevant staff actions.

The prior coordination step is an important element in a successful ACCES application because it provides the information on the scope and purpose of the exercise, providing the proper focus for the data collection efforts. If a given exercise is primarily to evaluate a modified Combat Service Support (CSS) system, then the data collectors will need to be located where CSS information is handled. Furthermore, some of the measures which focus on tactical situation information will need to be re-defined to incorporate the CSS focus. If a given exercise only involves one echelon or one or two staff elements within an echelon, then measures of staff coordination will be downplayed or ignored altogether in the training, data collection, and

analysis phases. The one ACCES failure was due a problems in this phase of the application. We attempted to apply ACCES during an evaluation of the All Source Analysis System (ASAS) but were unable to collect any meaningful data. In this instance, there was prior coordination, but the scope and form of the test was modified several times in the final weeks before the exercise; we were not able to obtain enough information early enough to successfully customize ACCES for this atypical exercise.

In our recent experience with ACCES applications, the units hosting our ACCES observers have all been involved in Battle Command Training Program (BCTP) training exercises, known as Warfighter Exercises (WFXs). The conditions for WFXs and many division-level CPXs (usually conducted by the division with corps involvement) are quite similar in terms of the number and types of CP elements which are involved. Under these circumstances, little or no special advance preparation is required to conduct a successful ACCES data collection effort. However, our past experience has shown us that apparently minor variations from the norm can severely disrupt data collection and data analysis to the point that little if any useful data is obtained, and few if any insights are generated from the analyses.

Obtaining and Training Data Collectors. ARI has taken steps in the last two years to establish and maintain a trained cadre of ACCES observers (data collectors) standing ready to go to an exercise. A task-order contract was awarded to Quantum Research International for ACCES data-collection and analysis support. Under this contract Quantum is committed to provide up to eight data collectors on any given exercise, and to support ARI in the analysis of the data following the exercise. The combination of the eight Quantum data collectors, one or two from within the Fort Leavenworth Field Unit staff, and one or two from other ARI elements puts us well on our way to finding the 16-20 data collectors required for an ACCES application. However, it is unlikely that any one agency, including ARI, will long be able to maintain enough experienced data collectors to provide more than a solid core of the necessary people. Even with experienced people, some refresher training is necessary. Current practice is to obtain supplementary volunteer data collectors from a variety of Army agencies and from government contractors. The benefit to the data collectors is the opportunity to see the C^2 processes in an actual unit, an invaluable experience for a young TRADOC staff officer or civilian contractor involved in designing the next-generation C^2 system. Data collectors will have a wide range of experience in tactical C^2, with most having very little such experience. Thus, training is required both on the ACCES procedures and on tactical C^2. Current practice is to gather the team of data collectors near the exercise site three days prior to the exercise. Two days are spent reviewing the ACCES procedures and other material; time is also allowed for orientation and coordination visits to the exercise sites and for discussions with BCTP personnel. EBR and their subcontractor, BDM, have developed training packages including Plans of Instruction (POI) and detailed back-up material for two-day initial training and for one-day refresher training; the POI for advanced training for ACCES analysts is currently being developed. See Appendix C for an outline of topics covered in the two-day POI.

Data Collection. During the exercise being observed, data collectors are stationed at "critical" C^2 nodes, as determined by the scope and purpose of the exercise. A given observer is stationed in the same location each day, and he or she occupies that position for roughly $12\frac{1}{2}$ hours each day, including the 10-15 minutes required at each end of the shift to hand off to the person on the alternate shift (assuming a 24 hour-per-day exercise schedule). The location may be one small area which can be observed almost entirely from a fixed point

(e.g., the G3-Plans cell at division Main) or may require movement among different points in order to be able to capture the data (e.g., a division Tactical CP). Data collectors are provided with a clipboard and data sheets and are asked to record all relevant information exchange. Discussions of the quality of the field rations are ignored, but receipt of a status update from a maneuver brigade, discussions of the likely intent of an enemy unit, or an assessment of the situation provided during a formal briefing or a shift-change briefing should always be noted. Periodically the data collector will record the location and other information about critical friendly and enemy units as posted on map overlays or status boards.

An additional data collector is stationed at the exercise simulation center. This person is responsible for capturing the simulation "ground truth" for later use in assessing the unit's timeliness and accuracy of information handling, their accuracy in forecasting future battlefield situations, etc. This observer needs to also maintain a clear awareness of the critical tactical and training events throughout the exercise. Our later analysis of data collected by each CP observer must be done in the context of the overall exercise, and only the simulation-center observer is in a position to provide that context. This observer also obtains the descriptive information about the unit and exercise listed in Appendix B.

Data analysis. The analysis of the raw data proceeds in two steps. The first step involves the "reduction" and "collation" of the data as recorded on the logs kept by the data collectors onto a set of intermediate "data-reduction forms" (see Appendix D). Some of the work done here could logically be grouped with the subsequent detailed analysis step; the practical distinction between the two is that the data reduction and collation draws from the hastily scrawled notes of several observers at different physical locations and different times, while the detailed data analysis draws primarily from the intermediate data forms.

The key ACCES concept which guides the data reduction and collation is the notion of a CYCLE variously referred to as a C^2 cycle, planning cycle, or decision cycle. As discussed on pages 6-9 above, the overall effectiveness of a C^2 system can be described in terms of the extent to which the plans generated by that system are robust. If the plans require only minor "course corrections", then the staff may be said to be more effective than if major adjustments to mission, organization, assets, schedule, or boundaries are required. Many staff elements are simultaneously engaged in many of the activities which make up the C^2 cycle; i.e., handling incoming information, tracking the situation (assessing the current situation and forecasting possible futures), planning and coordinating, and processing directives (see Figure 1, page 8). There are even cases where decisions are being made simultaneously in different locations. To make sense of this very complex set of activities, we work from decisions backward and forward through the data.

For example, assume that one of the data collectors has noted that, at a given time, the Assistant Division Commander for Maneuver (ADC(M)) told a G3 staff officer "I had hoped we would have more time, but it is clear that the covering force will not be able to hold until the 1st Brigade is in position. Tell them to begin withdrawing within 30 minutes and see if we can get some more artillery in there to give 1st Brigade more time." During data reduction and collation, these decisions are noted, and that observer's notes, and any others which are relevant, are scanned to determine the circumstances of the decisions. What information did the ADC(M) have available to him? Was it accurate, timely, complete? What interpretations or understandings had been stated? What predictions had been made? The data are also scanned to see the consequences of

the decision. How long did it take before an order was issued? Did the order match the decision? Was the order unambiguous? Or did subordinate commanders request clarification? If clarification was requested, how long a delay ensued before the clarification was provided? Were the subordinate commands allowed enough lead time between issuance of the order and the scheduled execution time for them to do their own planning and preparation?

In addition to the data reduction based on C^2 cycles, some data reduction is based on time intervals. Periodically, at pre-scheduled times, all data collectors will have noted the location and status data on critical units as posted within the CP they are observing This "monitoring" data is also transferred to one of the intermediate forms for later comparison against ground-truth data.

Depending on the number of ACCES personnel available, the intensity of the exercise, and the exercise schedule (8 *vs.* 12 *vs.* 24 hour days), some data reduction may take place during the exercise. Typically, however, thorough data reduction requires all data collectors to work together for two days following the exercise.

The second step of the data analysis is the more difficult and time consuming. During this phase two or three experienced analysts work together to develop the necessary quantitative ACCES measures from the information on the data-reduction sheets. For example, a judgement is made for each decision as to whether it involved changes to an existing plan or activation of a contingency within that plan. The information available to the decision maker is compared to ground truth to determine whether he had an accurate, timely, and complete picture of the battlefield when he made the decision. Percentages and averages are computed, and tables, charts, and graphs are prepared.

The following tables taken from Quantum reports on ACCES applications 91-1 (Castro, Collingwood, and Ervin; 1991), 91-2 (Castro, Hicks, and Ervin; 1991), and 91-3 (Gould, Collingwood, and Ervin; 1991), illustrate some of the results obtained. Figure 2 portrays an aggregation of the Plan Duration data in graphical form.

Table 3a Plan Duration (Hours) (Application 91-1)

	DAY					
CP	1	2	3	4	5	AGGREGATE
DMAIN	14.0	3.5	3.0	-	-	12.0

Discussion: Scores for this measure were based on the 13 FRAGOs issued by the division. All FRAGOs were issued by DMAIN. The median plan duration was 12 hours; however, on Days 2 and 3 four plans had duration times of less than four hours. This was due to mission and schedule changes necessitated by congestion on the main supply routes (MSRs) delaying the advance of division units. Median values for plan duration could not be derived for Days 4 and 5, as a plan implemented on Day 4 was still in effect at ENDEX, 29.9 hours later, as was a Day 5 plan that had been in effect for 12 hours. Duration of the division's plans reflects the battle activity: long duration plans in first days during marshalling operations, short duration plans during initial contact, and longer duration plans again during preparation for and conduct of the defense.

Table 3b Plan Duration (Hours) (Application 91-2)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	-	0.8	3.2	4.8	–	3.8
DREAR	-	6.9	-	-	–	6.9
All	-	3.9	3.2	4.8	–	4.2

Discussion: Scores for this measure were based on nine of the ten FRAGOs issued by the division after STARTEX. One plan, implemented on Day 4, could not be scored, as it was still in effect at ENDEX, after 27.3 hours. DMAIN issued all FRAGOs except for one which was issued by DREAR. The median plan duration, based on the nine plans scored, for the division was 4.2 hours. As indicated in [the table] on Day 2, one plan lasted less than an hour due to schedule changes necessitated by congestion on the main supply routes (MSRs) that caused the division to prioritize unit movement on the MSR. This schedule change was implemented in the FRAGO issued by DREAR.

There were no plans implemented on Day 5, and median value for plan duration derived for Day 4 is not a true representative because of the plan that was still in effect at ENDEX. Duration of the division's plans reflected the battle activity; short duration plans during the offense and longer duration plans during preparation for and conduct of the defense.

Table 3c Plan Duration (Hours) (Application 91-3)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	6.2	3.4	12.7	5.0	-	5.5
DTAC	-	-	4.5	-	-	4.5
DREAR	-	4.0	4.5	2.8	-	4.0
All	6.2	4.0	6.4	4.0	-	4.5

Discussion: The division issued 33 FRAGOs for this exercise, seven of which were issued prior to STARTEX and not scored. Of the remaining 26 FRAGOs, five were administrative directives (e.g., division CSM setting up division training program) and one still in effect at ENDEX could not be evaluated for duration. The median duration of the plans implemented by the 20 FRAGOs scored was 4.5 hours. The short duration of plans was driven by numerous task organization and mission changes designed to maintain offensive momentum and control of the MSRs (traffic, refugees, and enemy interference). The division was compelled to change task organizations on 12 different occasions during the exercise because of unexpectedly strong enemy reaction.

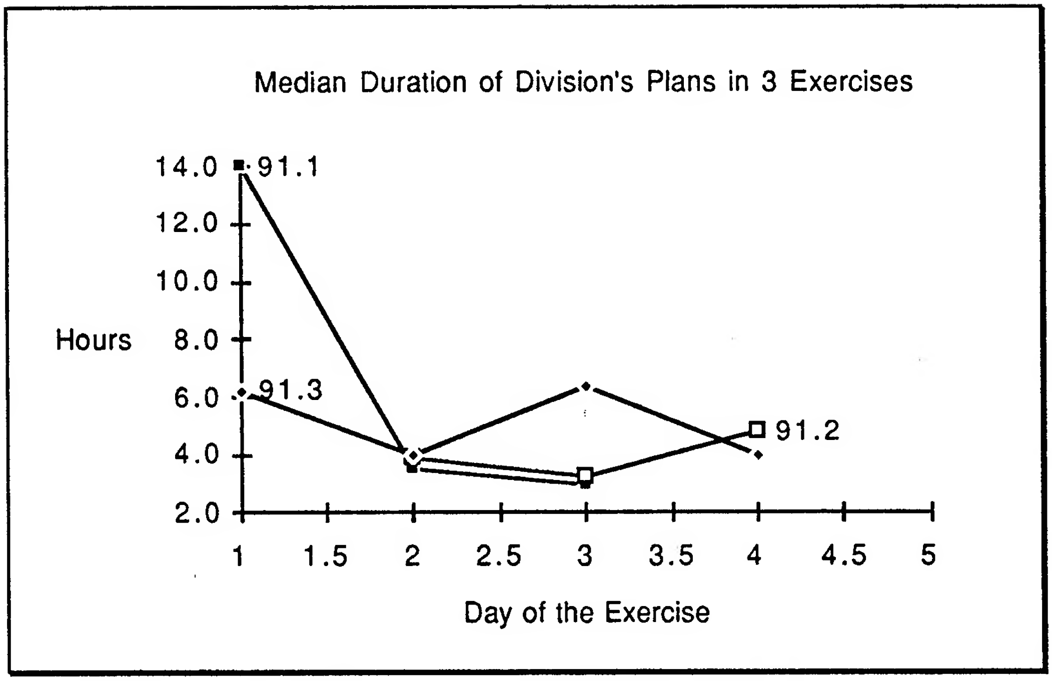


Figure 2. Aggregation of Plan Duration data from three exercises.

Table 4a Completeness of FSAs (%) (Application 91-1)

	DAY					
CP	1	2	3	4	5	AGGREGATE
DMAIN	-	0 [0/4]	-	0 [0/1]	-	0 [0/5]
DTAC	17 [1/6]	0 [0/19]	11 [1/9]	0 [0/10]	0 [0/3]	4 [2/47]
DREAR	-	0 [0/1]	-	-	-	0 [0/1]
3d Bde	0 [0/1]	0 [0/12]	0 [0/8]	0 [0/5]	0 [0/1]	0 [0/27]
All	14 [1/7]	0 [0/36]	6 [1/17]	0 [0/16]	0 [0/4]	3 [2/80]

Discussion: Staffs at all levels prepared incomplete assessments of the friendly situation. Discussion of combat service support was missing more than 80% of the time, and discussion of task organization was missing more than 60% of the time. During formal briefings the FSAs included only unit activities. Incomplete FSAs led to a misunderstanding on Day 1 of the status of fuel at the refuel-on-the-move (ROM) sites, which held up progress in movement of a brigade. Missing CSS elements in FSAs necessitated several "quick looks" to identify possible shortages of FASCAM and artillery ammunition.

Table 4b Completeness of FSAs (%) (Application 91-2)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	50 [1/2]	40 [2/5]	0 [0/3]	33 [1/3]	0 [0/2]	27 [4/15]
DTAC	0 [0/5]	33 [1/3]	33 [1/3]	0 [0/2]	0 [0/1]	14 [2/14]
DREAR	-	50 [1/2]	100 [1/1]	–	–	67 [2/3]
2d Bde		0 [0/2]	–	–	–	0 [0/2]
All	11 [1/9]	40 [4/10]	29 [2/7]	20 [1/5]	0 [0/3]	24[8/34]

Discussion: Staffs throughout the division prepared incomplete assessments of the friendly situation. Discussion of combat service support was missing more than 60% of the time, and discussion of task organization was missing more than 45% of the time. Some incomplete assessments led to confusion regarding which units were in division reserve for the attack phase on Day 2 and led to doubt as to the adequacy of combat power in conducting a river crossing.

Table 4c Completeness of FSAs (%) (Application 91-3)

CP	DAY 1	2	3	4	5	AGGREGATE
DMAIN	-	25 [1/4]	13 [1/8]	0 [0/4]	0 [0/9]	8 [2/25]
DTAC	0 [0/2]	33 [2/6]	100 [2/2]	60 [3/5]	-	47 [7/15]
2d Bde	100 [1/1]	100 [1/1]	-	-	100 [1/1]	100 [3/3]
All	33 [1/3]	36 [4/11]	30 [3/10]	33 [3/9]	10 [1/10]	28 [12/43]

Discussion: Staffs at all levels prepared incomplete assessments of the friendly situation. Division planners, in reacting to a succession of failed plans, began using only the most readily available friendly situation information, usually friendly activity and status, in their haste to publish yet another plan. Thus a series of planning cycles resulted in the publication of plans which failed, in part, due to incomplete FSAs.

Report preparation. Once the data have been analyzed and formatted into summary form, a report is written which provides an assessment of the C^2 processes observed during the exercise. This stage requires considerable expertise if the report is to be of any value to the unit or to an outside agency such as OPTEC. A finding that the TAC CP had accurate information (as defined by the unit's SOP) on the location of critical enemy units only 70% of the time is practically meaningless without some context information. How does this compare with other similar units which have been observed? Did the data collectors note any problems in the data flow between the G2 and the TAC CP? Was an inexperienced, unsupervised soldier misreading the grid coordinates when he posted the information? Did the ADC(M) or a G3 staff officer note the problem and attempt to obtain more timely information? Were any minor, moderate, or major planning cycles initiated on the basis of the faulty information?

During our recent ACCES applications (four in 1991) we have focused a great deal of attention on the form and content of ACCES exercise reports. One of the difficulties we have encountered is balancing the two somewhat contradictory goals of: a) preserving all possible information about the exercise for archival purposes and to facilitate later analyses; and b) providing succinct, meaningful feedback to the host unit. As ACCES has evolved, we have tended toward collecting and reporting more and more detailed information. The principal motivation for the changes from ACCES versions 91-1 and 91-2 to version 91-3 as described in this report is the perceived need to avoid getting lost in the details. By identifying new "primary" measures, most of which are aggregations of existing measures, we believe we have achieved a more intelligible structure for reporting and explaining our data.

ACCES status

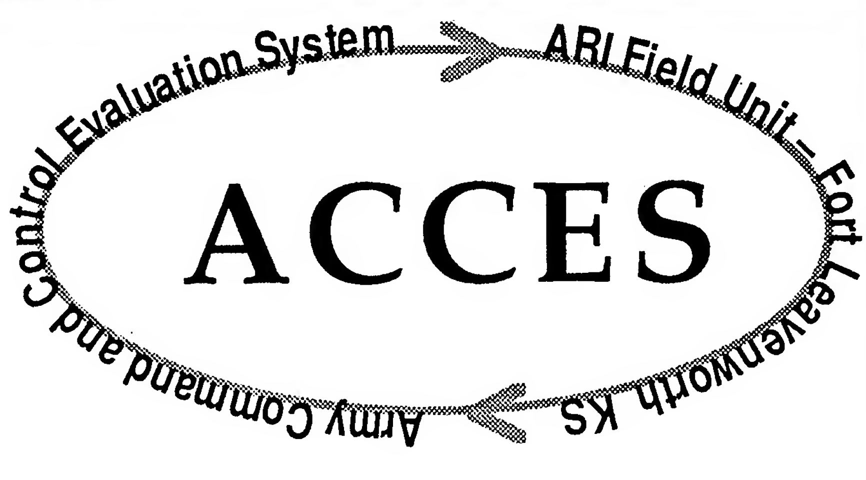
ARI is continuing the development of ACCES. Current ARI efforts have three primary objectives: a) bringing the measures into synchrony with tasks and standards as described in Army doctrine; b) streamlining the data collection process; and c) streamlining the data analysis process. The goal is to provide the Army with a "turnkey" measurement system which can be used easily and effectively by a unit conducting a CPX, by a Test and Evaluation agency, or by researchers concerned with specific aspects of command and control. A parallel project, being conducted in cooperation with the Center for Army Lessons Learned, is developing a C^2 Performance database which will allow analysts to identify communalities in unit performance through examination of ACCES and other data collected during several exercises. During these developmental projects we will continue to apply ACCES during division and corps exercises, and we will continue to provide feedback to the units being observed.

For additional information about ACCES or to obtain copies of ACCES documentation and reports, please contact any of the ACCES team members.

Stanley M. Halpin
Robert E. Solick
Douglas K. Spiegel

ARI Field Unit
P.O. Box 3047
Fort Leavenworth,
KS 66027-0347

AV552-4933
913/684-4933



References

Castro, F. D. Jr., Collingwood, C. E., and Ervin, J. R (1991, August) ACCES Assessment of Command and Control During a Division Level CPX, Late Spring 1991 (ACCES Application 91-01) (Technical Report QCR91-018-003). El Paso TX: Quantum Research International.

Castro, F. D. Jr., Hicks, H. E., Jr., and Ervin, J. R (1991, October) ACCES Assessment of Command and Control During a Division Level CPX, Summer 1991 (ACCES Application 91-02) (Technical Report QCR91-018-008). El Paso TX: Quantum Research International.

Crumley, L. M. (1989, January) Review of Research and Methodologies Relevant to Army Command and Control Performance Measurement (ARI Technical Report 825). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD)

Crumley, L. M. and Sherman, M. B. (1990, September) Review of Command and Control Models and Theory (ARI Technical Report 915). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (AD)

Defense Systems, Inc. (1986, April) MCS HEAT Handbook. (Unpublished Report) McLean, VA.

Defense Systems, Inc. (1990, January) ACCES Handbook. (Unpublished Report) McLean, VA.

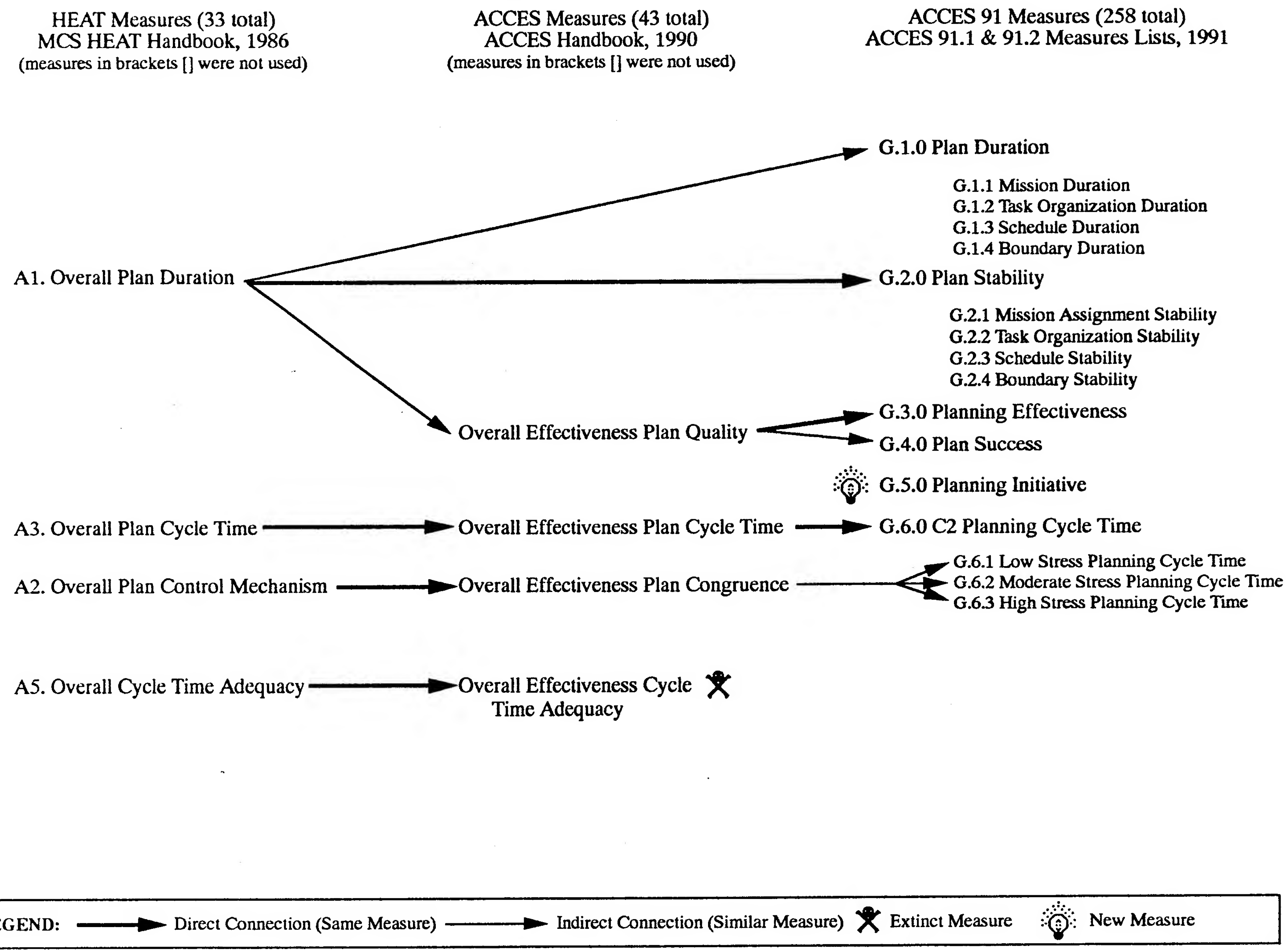
Evidence Based Research (1991, April) Enhancements to the Army Command and Control Evaluation System (ACCES), Task 2 Draft Technical Report. (Unpublished Report) Vienna, VA.

Gould, R. M., Collingwood, C. E., and Ervin, J. R (1991, November) ACCES Assessment of Command and Control During a Division Level CPX, Summer 1991 (ACCES Application 91-03) (Technical Report QCR91-018-009). El Paso TX: Quantum Research International.

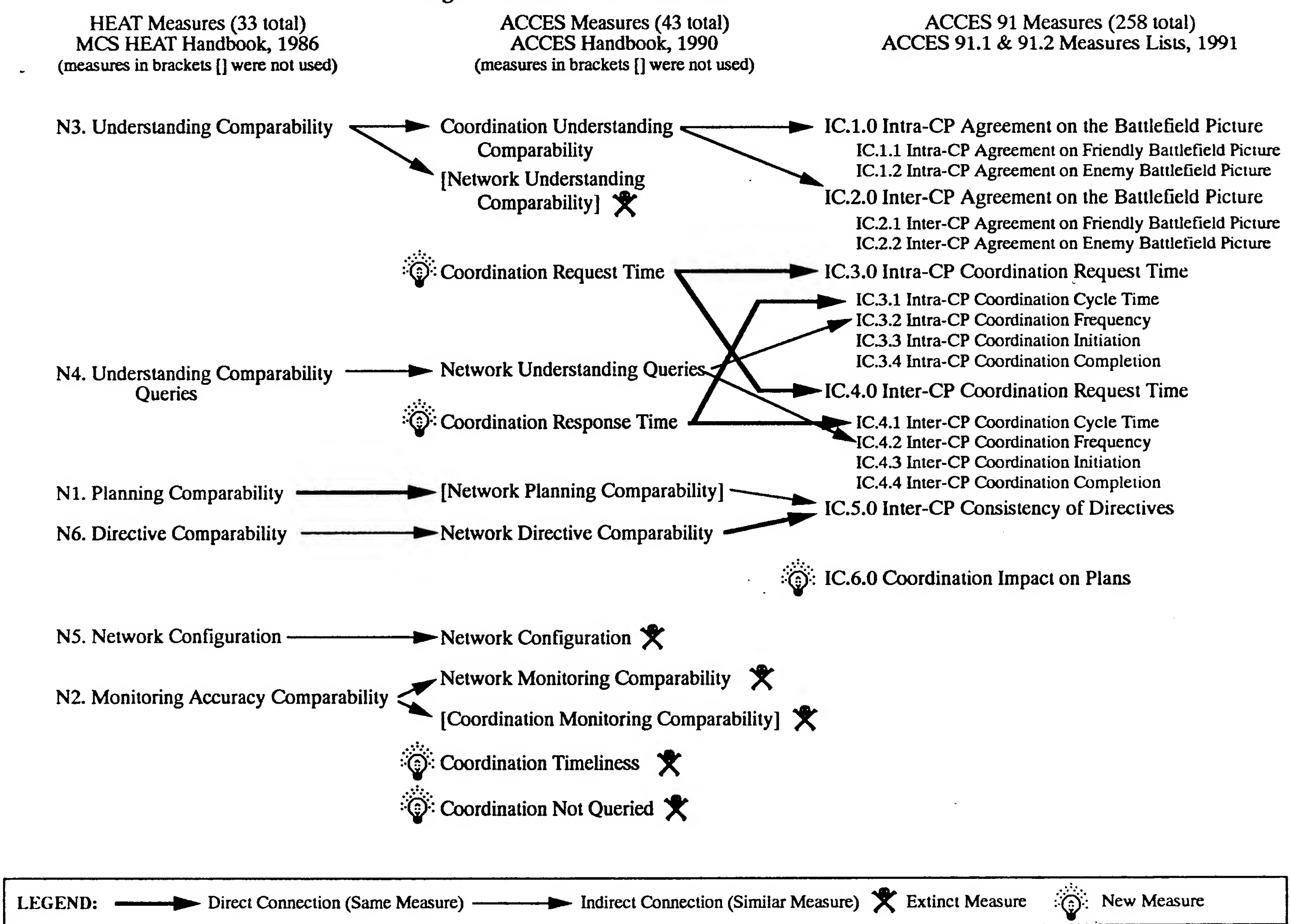
APPENDIX A

Evolution of ACCES Measures

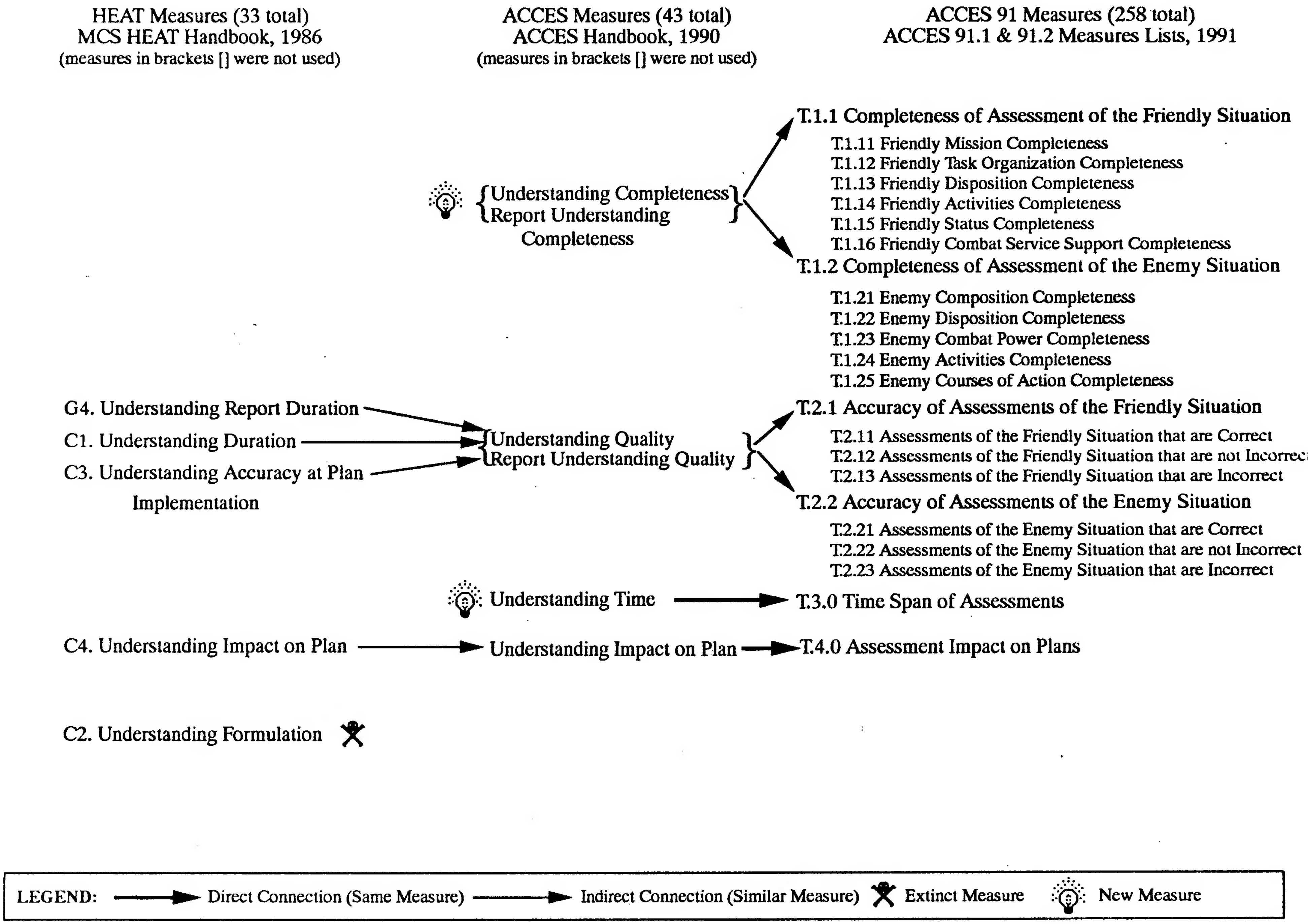
Lineage of General Measures



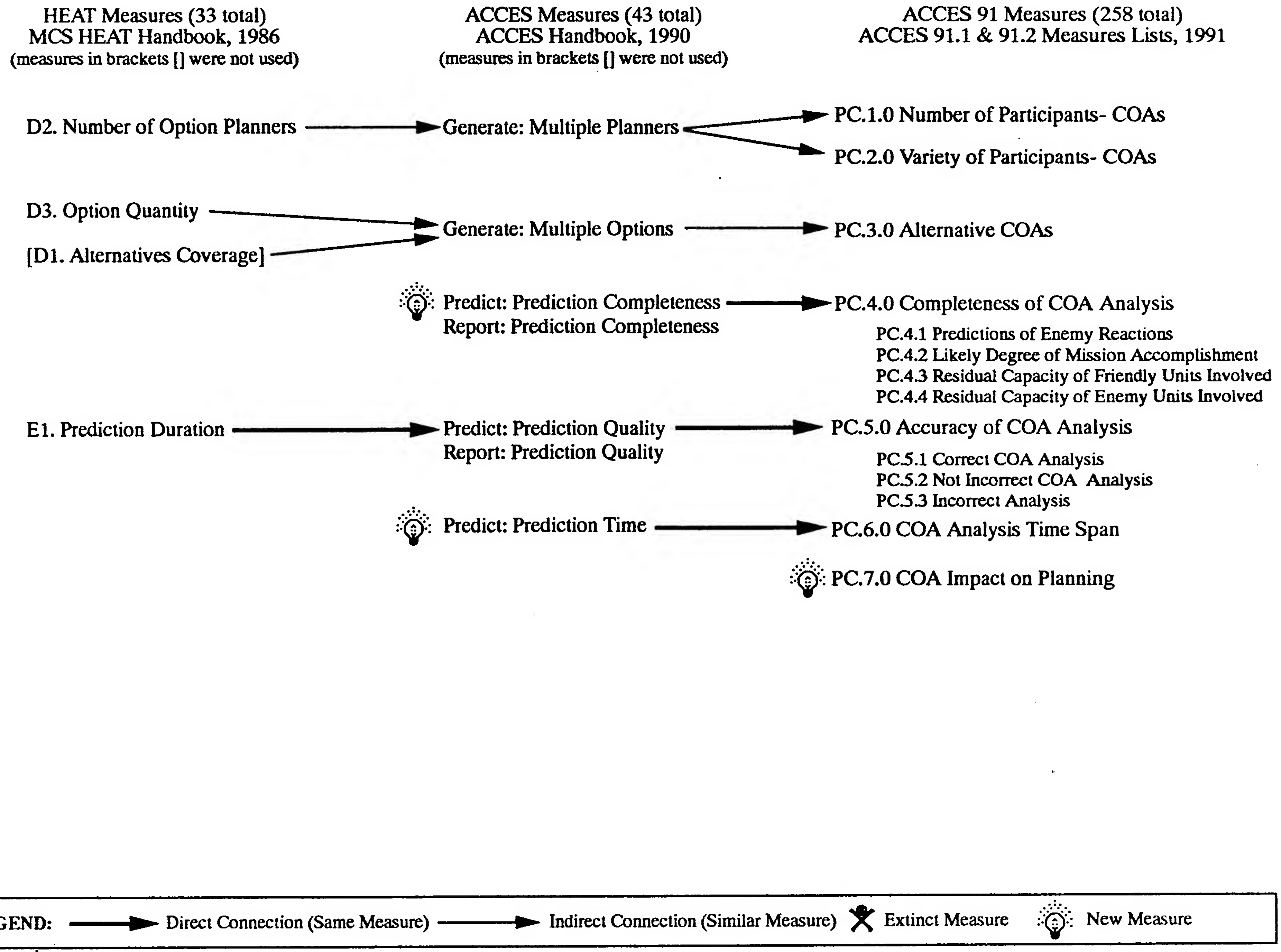
Lineage of Information Coordination Measures



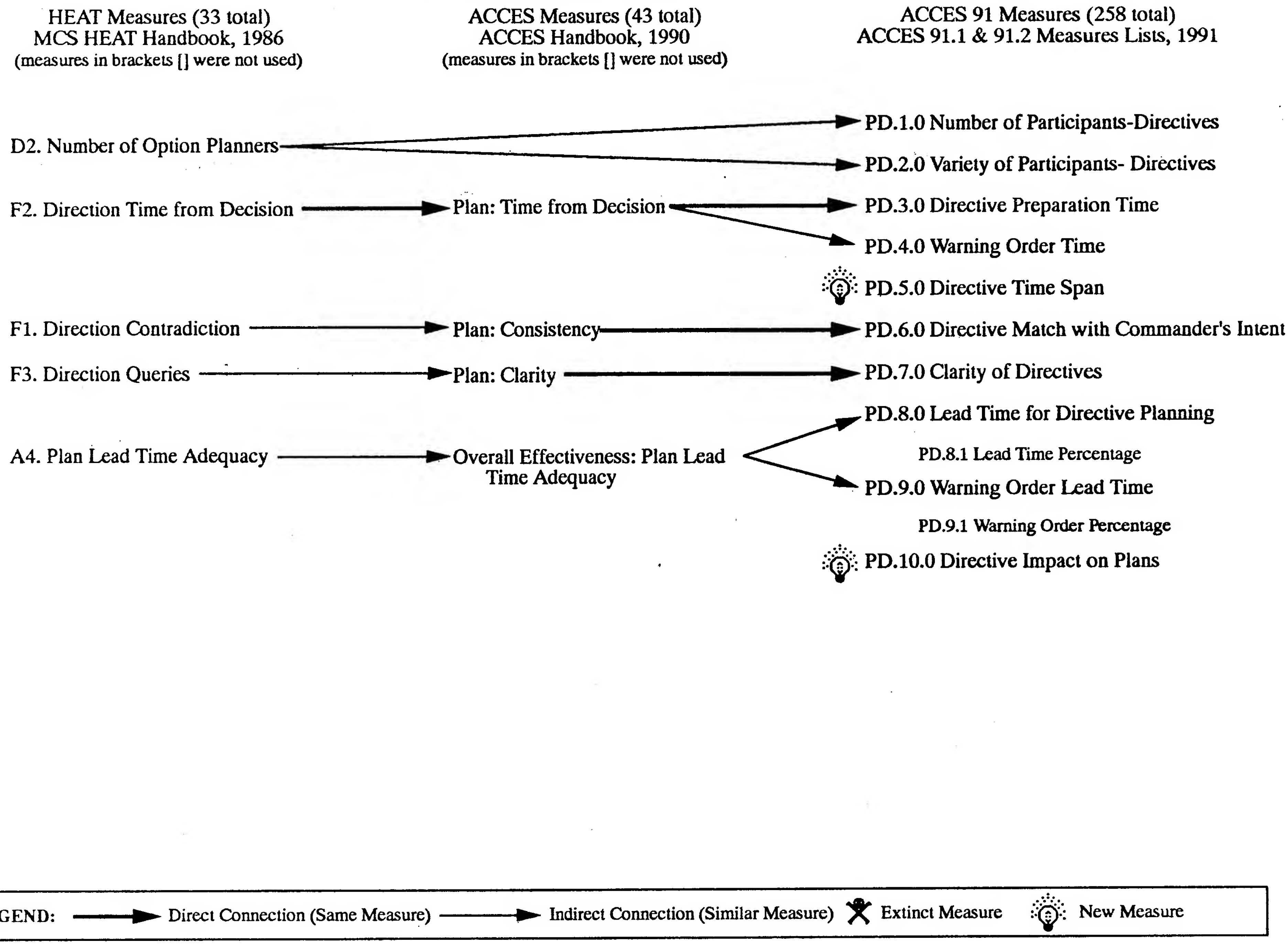
Lineage of Tracking Measures



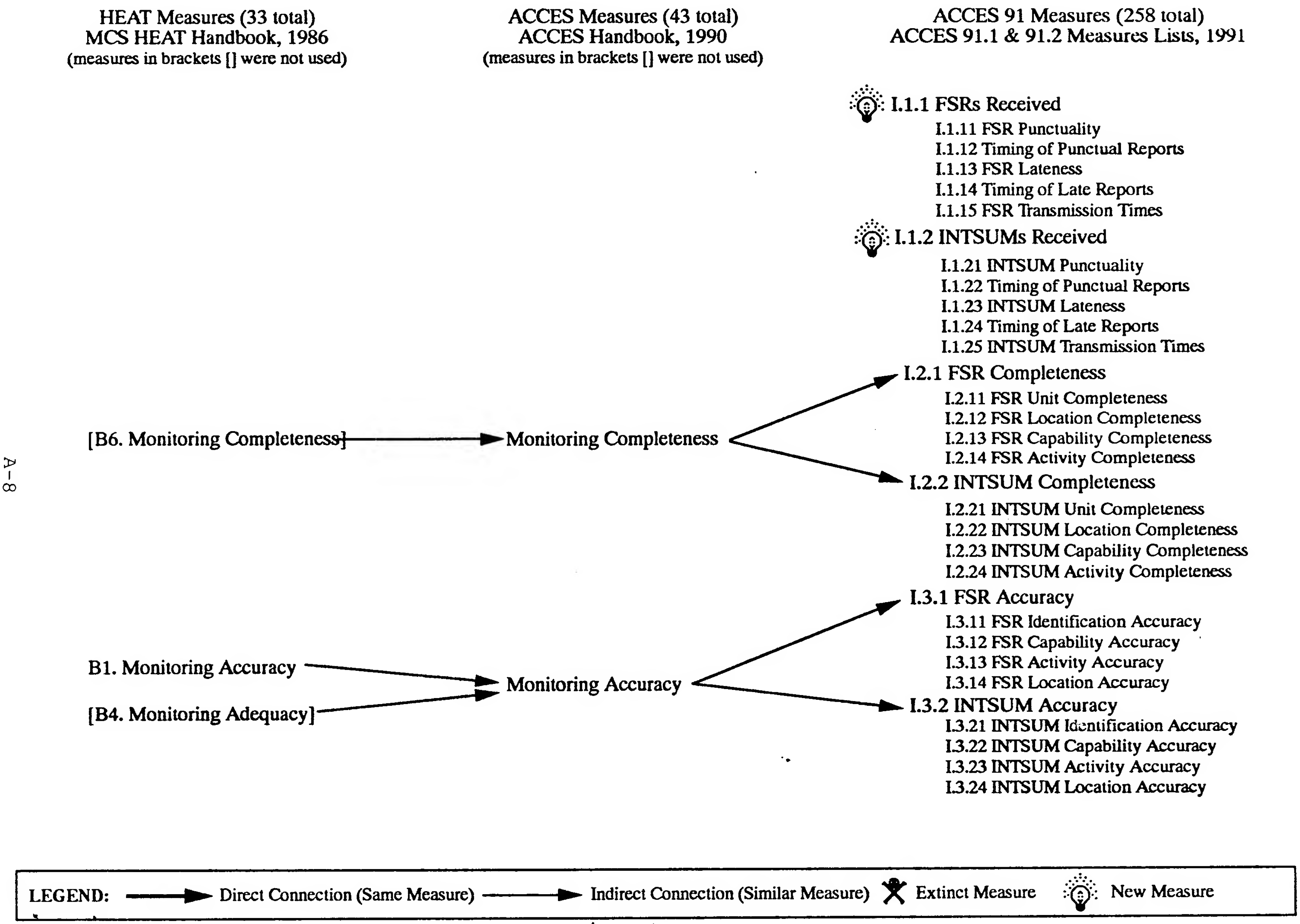
Lineage of Predict COA Measures



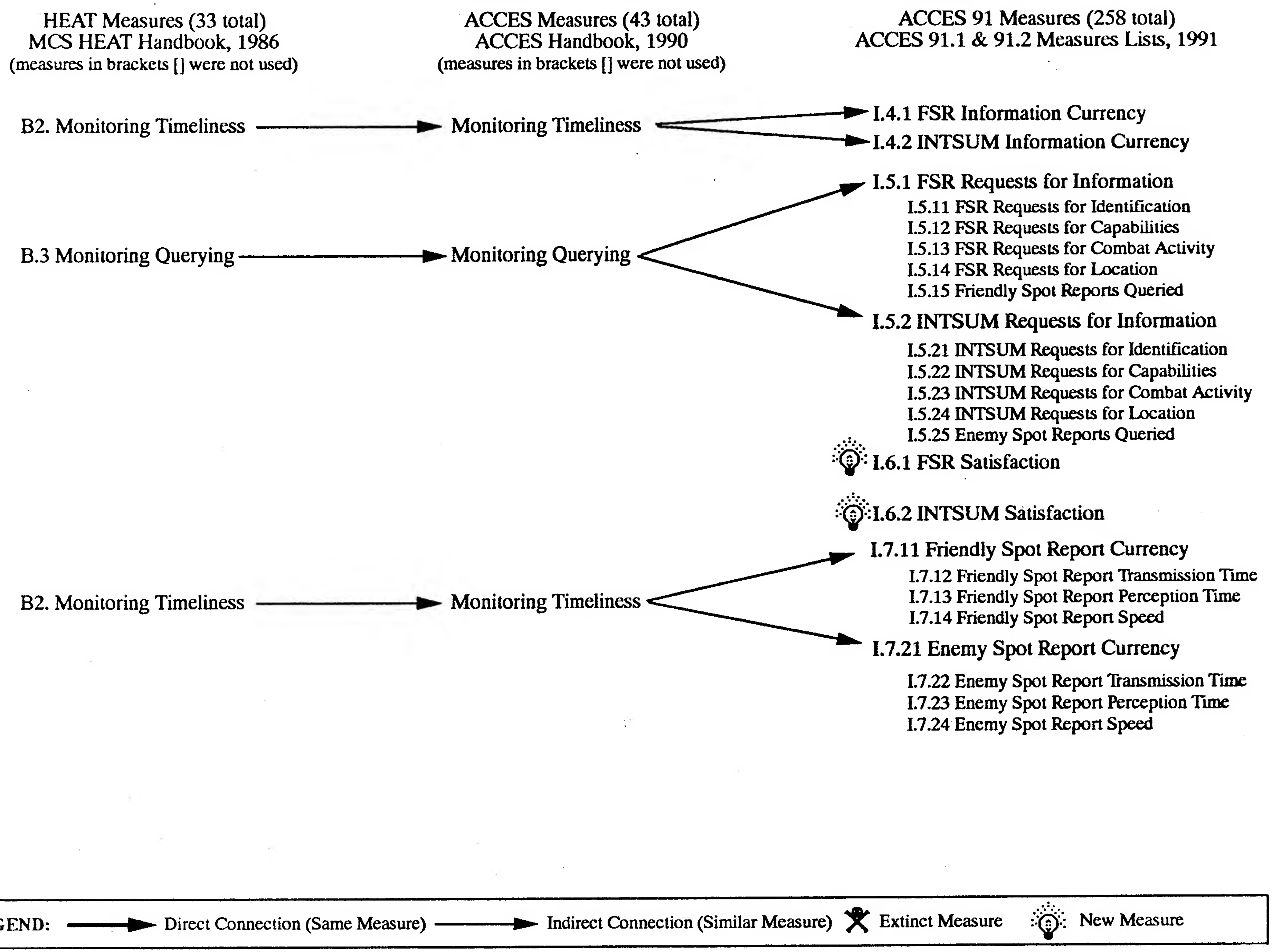
Lineage of Preparation of Directive Measures



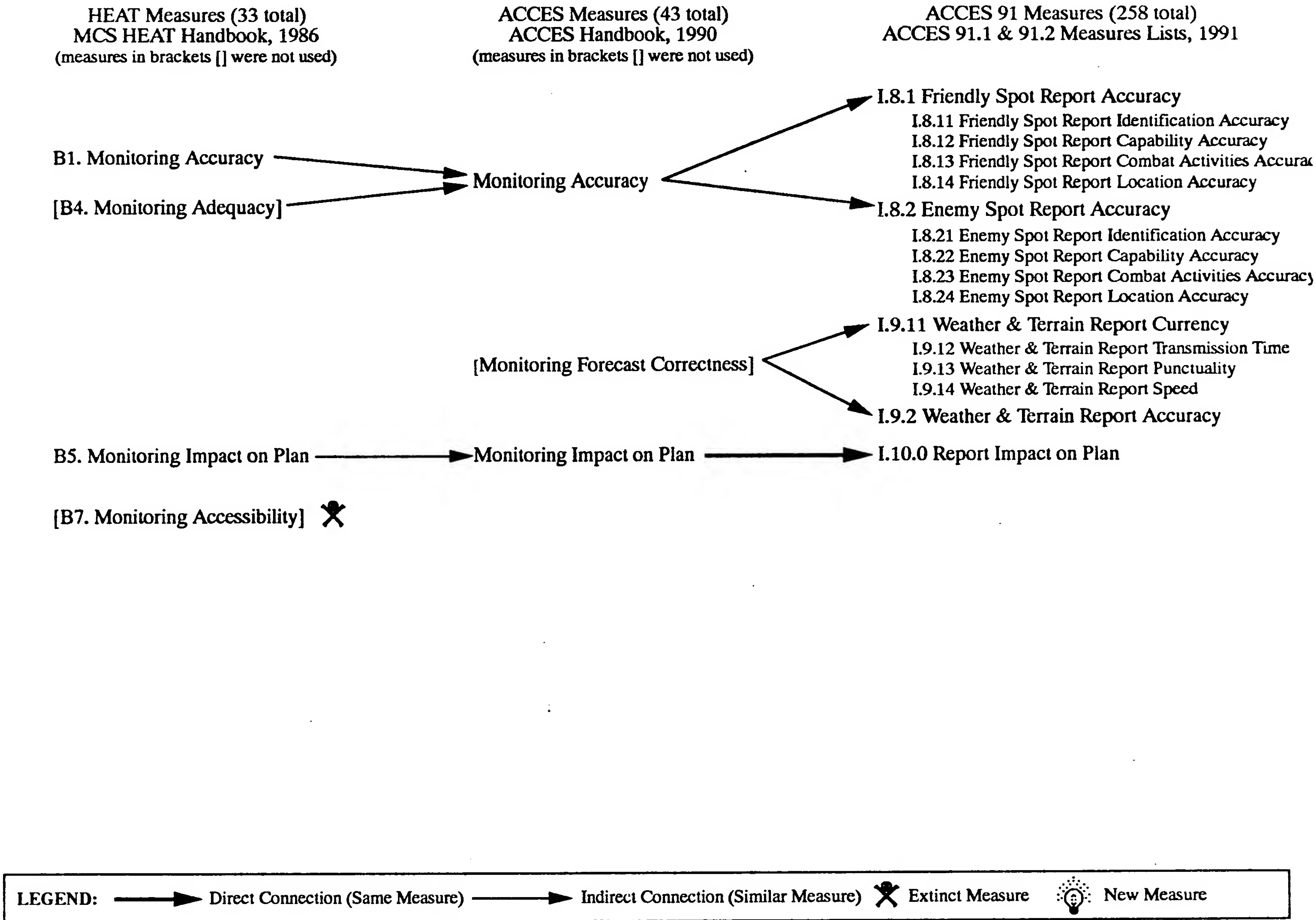
Lineage of Incoming Information Handling Measures



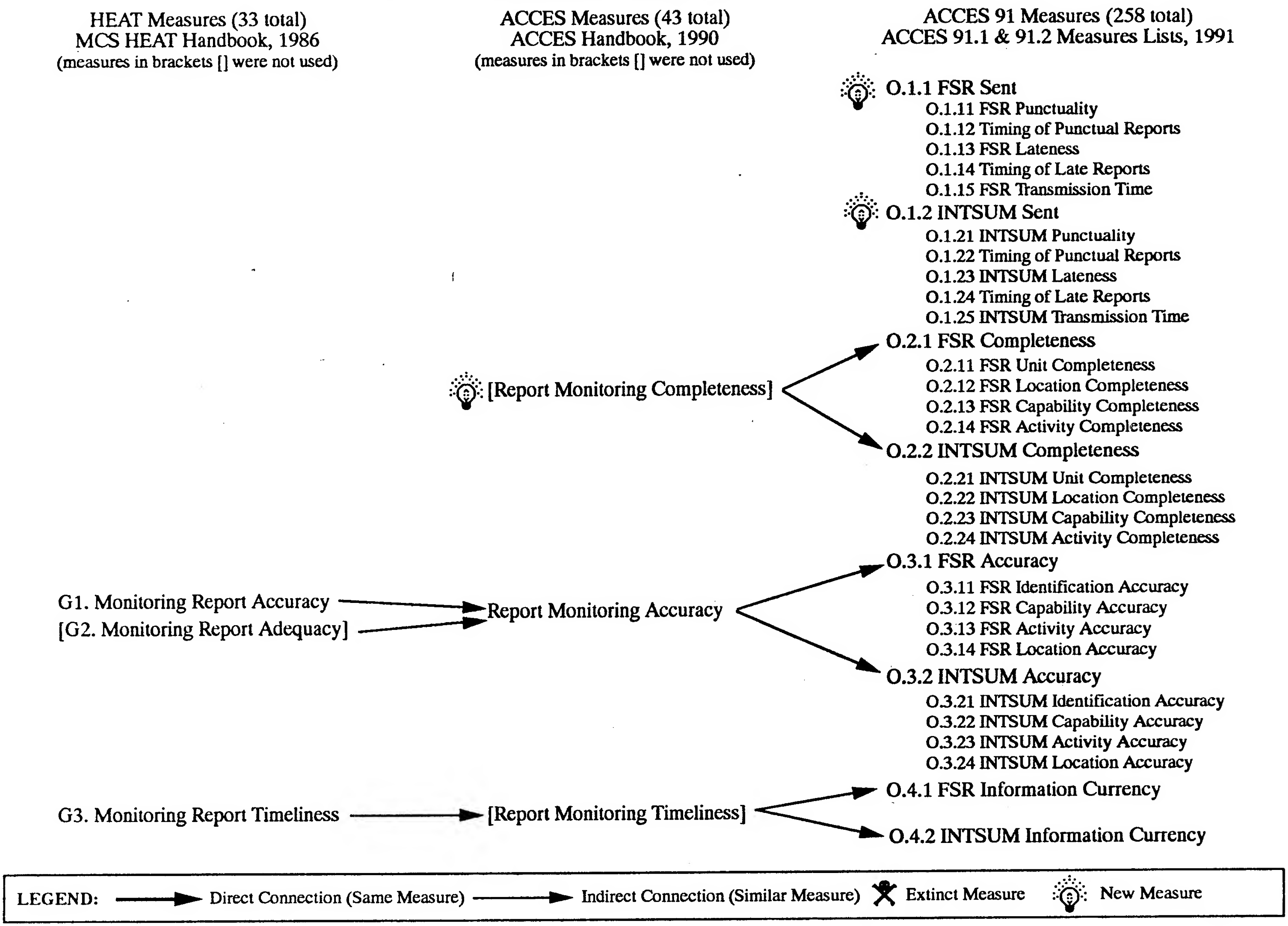
Lineage of Incoming Information Handling Measures (continued)



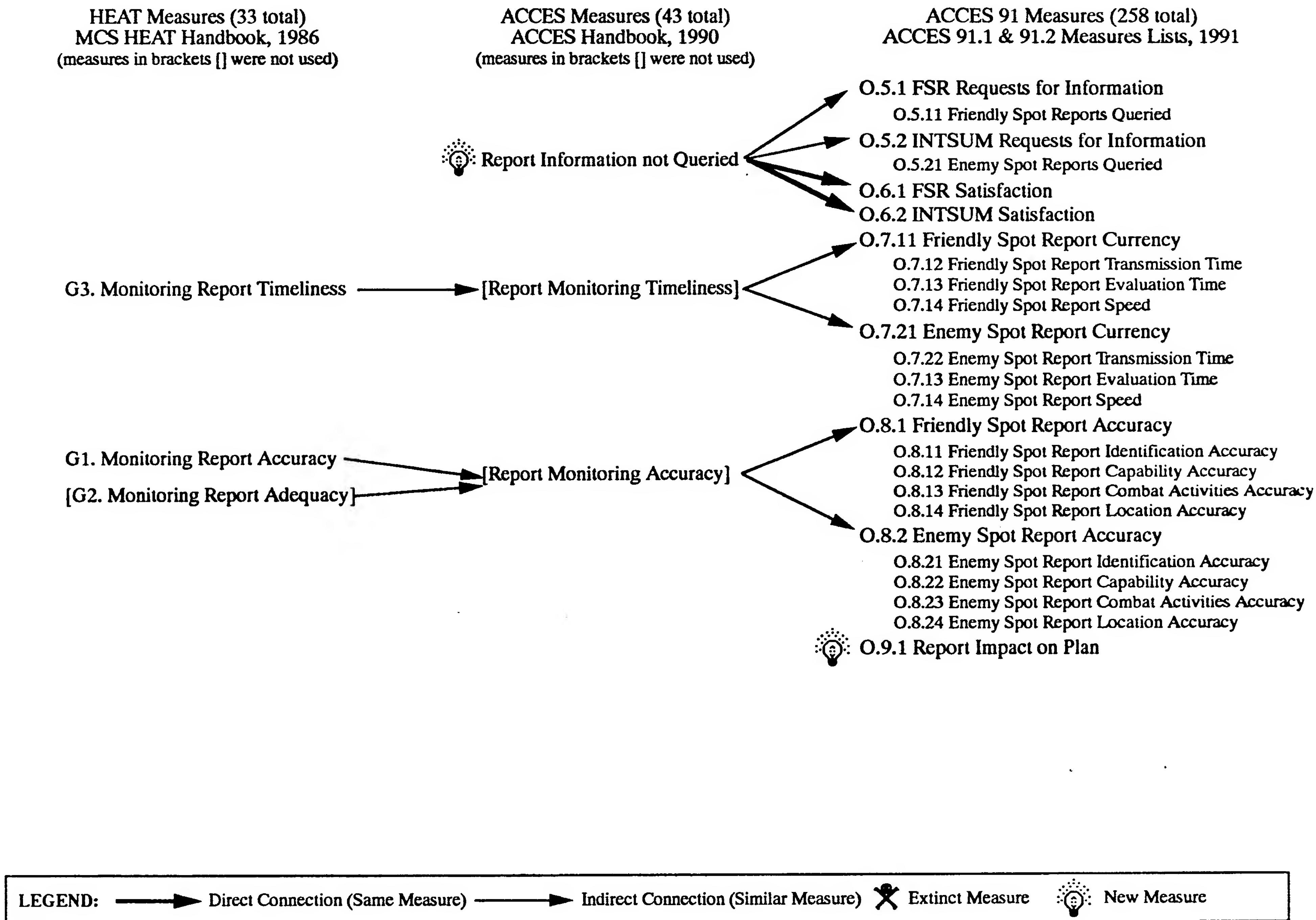
Lineage of Incoming Information Handling Measures (continued)



Lineage of Outgoing Information Handling Measures



Lineage of Outgoing Information Handling Measures (continued)



MCS HEAT HANDBOOK

15 APRIL 1986

Prepared By:

Defense Systems, Inc.
7903 Westpark Drive
McLean, Virginia 22102
(703) 883-1000

Table 3-1. OVERALL NODE MEASURES

MOE #	MOE TITLE	DEFINITION	DATA CATEGORIES
A1*	Overall Plan Duration	Percentage of intended period plan is in force	Operations Personnel Intelligence Logistics
A2*	Overall Plan Control Mechanism	Percentage of control cycles arising from minor, moderate, or major incongruence	As for A1
A3°	Overall Plan Cycle Time	Average time used to complete the control cycle given full planning, minor incongruence, adaptive behavior (surprise)	As for A1
A4°	Overall Plan Lead Time Adequacy	Percentage of directives for which planning lead time provided to subordinates is inadequate	As for A1
A5°	Cycle Time Adequacy	Percentage of adaptations not attempted due to insufficient lead time	As for A1

*Indicates measure of effectiveness

°Indicates measure of process quality that can be converted into a measure of effectiveness if a parameter can be supplied by doctrine, theory, or empirical estimation.

Table 3-2. NODE PROCESS MEASURES
(1 of 3)

MOE #	MOE TITLE	DEFINITION	DATA CATEGORIES
B1°	Monitoring Accuracy	Percentage of units where headquarters data are outside desired window	Enemy-Close Air Support ARTY, DIV, REG, BN, Follow-on echelon, ADA--type[1], strength, movement, log Own-DIV, Corps MSC, Adjacent, supporting, AWACS availability--location, task org, status, [2] plans, mode of operation[3]
B2°	Monitoring Timeliness	Percentage of units where most recent data are outside desired time window	As for B1, B4
B3°	Monitoring Querying	Percentage of over age data not queried by HQ	As for B2
B4	Monitoring Adequacy	Percentage of units located with good, adequate, and inadequate accuracy	Enemy Units[1]
B5*	Monitoring Impact on Plan	Percentage of plans changed because HQ perception did not match truth	Weather, terrain, flight corridors, enemy aves of approach, enemy aircraft attack routes
B6	Monitoring Completeness	Percentage of Commanders information requirements for which there is no data	CCIR
B7	Monitoring Accessibility	Percentage of information received but not accessed by staff because of inability to access; data not stored; data dumped	CCIR

Footnotes for Table 3-2 are found on page 3-8.

Table 3-2. NODE PROCESS MEASURES
(2 OF 3)

MOE #	MOE TITLE	DEFINITION	DATA CATEGORIES
C1*	Understanding Duration	Percentage of intended period hypotheses about enemy situation are: correct, not incorrect, or incorrect	Enemy Objectives, assets assigned, reserves time-table, location of main attack
C2	Understanding Formulation	Percentage of time there is no hypothesis about enemy situation	As for C1
C3o	Understanding Accuracy at Plan Implementation	Percentage of attempts made to implement a HQ decision in which the match between the predicted and actual own force situation is wrong or left unmade	Personnel, availability, Intelligence Assets Overall Division Operations Plans Individual Component Plans Change in supply by class Situation Change in service/support Change in critical shortages
C4*	Understanding Impact on Plan	Percentage of plans changed because situation was misforecast	Weather, terrain and as for C1
D1*	Alternatives Coverage 4	Percentage of all alternative futures hypothesized in "Understand" examined during the planning process and alternative courses of action planned for each contingency	Enemy Objectives, assets assigned, reserves time-table, location of main attack
D2	Number of Option Planners	How many people participated in the development of options for dealing with the "future"?	Personnel availability, Intelligence Assets Overall Division Operations Plans Individual Component Plans

Table 3-2. NODE PROCESS MEASURES (2 of 3) (Continued)

MOE #	MOE TITLE	DEFINITION	DATA CATEGORIES
D3	Option Quantity	How many people participated in the development of options for dealing with the future considered to be most likely to occur?	Change in supply by class Change in movement Situation Change in service/support Change in critical shortages

Footnotes for Table 3-2 are found on page 3-8.

Table 3-2. NODE PROCESS MEASURES
(3 of 3)

MOE #	MOE TITLE	DEFINITION	DATA CATEGORIES
E1*	Prediction Duration [5,6]	Percentage of intended period predictions are: correct, in the contingency set, or incorrect	As for D1
F1	Direction Contradiction	Percentage of assignments in directives which contradict the assignments of the Commander's decision(s)	Mission, assets, boundaries, time-table
F2	Direction Time from Decision	Average time taken to issue a directive after a decision has been made	Operations
F3*	Direction Queries	Average number of queries received per directive	
G1°	Monitoring Report Accuracy	Percentage of units where reported data on units are outside the desired accuracy window	Enemy Units Own Forces
G2	Monitoring Report Adequacy	Percentage of reports with good, adequate, and inadequate accuracy	Enemy unit location, Weather, terrain
G3°	Monitoring Report Timeliness	Percentage of units where reported data are outside the desired time window	Enemy Units Own Forces
G4*	Understanding Report Duration	Percentage of intended period reported hypotheses about units are: correct, in the contingency set, incorrect, or never reported	Own Force Enemy Forces Terrain, weather

* Indicates measure of effectiveness

° Indicates measure of process quality that can be converted into a measure of effectiveness if a parameter can be supplied by doctrine, theory, or empirical estimation.

Footnotes for Table 3-2 are found on page 3-8.

Table 3-3 NETWORK PROCESS MEASURES

MOE #	MOE TITLE	DEFINITION	DATA CATEGORIES
N1	Planning Comparability	Alternate and backup nodes have current information, adequate capacity, and no conflicting assignments	Option Generation, Decision
N2	Monitoring Accuracy Comparability	Measured by formula: $-\ (n_i/n)\log_2(n_i/n)$ where: n_i = of nodes agreeing with each other; n = # of nodes	As for B1
N3	Understanding Comparability	Percentage of hypotheses about enemy objectives that coincide, overlap significantly, or differ	As for C1
N4	Understanding Comparability Queries	Percentage of attempts made to implement a HQ decision in which differences in perception about own force situation causes queries	As for C3
N5	Network Configuration	Percentage of nodes incorrectly identified or not identified	Superior, subordinate, adjacent nodes
N6	Directive Comparability	Percentage of directives and/or guidance issued by alternate and/or backup nodes which are redundant or conflict with existing directions	Mission, assets, schedule, and boundaries

ACCES HANDBOOK

January 1990

Prepared For:

Army Research Institute
Ft. Leavenworth, KS

Prepared By:

Defense Systems, Inc.
1521 Westbranch Drive
McLean, Virginia 22102
(703) 883-1000

Overall Effectiveness Measures

CATEGORY	TITLE	DEFINITION
DECIDE	PLAN QUALITY	Number of plan assignments that remain in force unchanged for the intended period, expressed as a percentage of the total assignments. The assignments in a plan are: mission, assets, boundaries, and schedules. The intended period is the time stated in the implementing directive or command briefing. The time the plan is in force is the time from implementation to the time(s) the plan is changed or abandoned.
	PLAN CONGRUENCE	Number of control cycles arising from minor, moderate, or major incongruence, expressed as a percentage of total control cycles.
PLAN	PLAN CYCLE TIME	Median time used to complete the control cycle given minor, moderate, or major incongruence. The time is measured from the headquarters perception of an event until a directive is issued or a decision is made to do nothing.
DIRECT	PLAN LEAD TIME ADEQUACY	Number of directives for which planning lead time provided to subordinates is adequate, expressed as a percentage of the total number of directives. Adequacy of lead time can be defined by the command directing implementation, the implementing command, doctrine, the times in the directive (e.g., an implementation time prior to time of receipt), or by the events themselves.
	CYCLE TIME ADEQUACY	Number of directives for which lead time is sufficient to permit an attempt at adaptation, expressed as a percentage of total directives. Insufficient lead time occurs when a desired course of action is discarded because time is not available for accomplishment.

Monitoring Measures

CATEGORY	TITLE	DEFINITION
MONITORING	COMPLETENESS	Number of Commander's information requirements (CIR) for which there are data, expressed as a percentage of CIR items.
	ACCURACY	Number of units for which headquarters data are within the desired window, expressed as a percentage of the total number of units monitored. The desired window may be specified by the command, by doctrine, or developed parametrically. Units are friendly and enemy units of interest.
	QUERYING	Number of units where most recent data are outside the desired time window and the data is queried, expressed as a percentage of the total number of units for which most recent data are outside the desired time window. The desired window may be specified by the command, by doctrine, or developed parametrically. Units are friendly and and enemy units of interest.
	TIMELINESS	Number of units for which the most recent data are within the desired time window, expressed as a percentage of the total number of units of interest. The desired window may be specified by the command, by doctrine, or developed parametrically. Units are friendly and enemy units of interest.
	IMPACT ON PLAN	Number of control cycles initiated because of monitoring errors, expressed as the percentage of total control cycles initiated and subtracted from 100 percent.
	FORECAST CORRECTNESS	Number of predictions of time at which change in weather and terrain will occur that are correct, expressed as a percentage of the total number of predictions.

Understanding Measures

CATEGORY	TITLE	DEFINITION
UNDERSTANDING	COMPLETENESS	Percentage of periodic briefings requiring an understanding of the situation to be expressed, at which the understanding is actually stated.
	QUALITY	Number of perceptions of the situation held by the headquarters, scored as percentage correct, not incorrect, or incorrect.
	IMPACT ON PLAN	Number of control cycles caused because headquarters understanding did not match ground truth, expressed as a percentage of total control cycles initiated and subtracted from 100 percent.
	UNDERSTANDING TIME	Median time from the expression of and understanding to the end of the period which the understanding covers.

Generate/Predict and Plan Measures

CATEGORY	TITLE	DEFINITION
GENERATE OPTIONS	MULTIPLE PLANNERS	Number of estimates for which two or more staff members participate in the development of alternative courses of action, expressed as a percentage of the total number of estimates presented to the Commander.
	MULTIPLE OPTIONS	Number of estimates for which more than one option was considered for the future most likely to occur, expressed as a percentage of the total number of estimates presented to the Commander.
PREDICT	PREDICTION COMPLETENESS	Number of estimates that include, for each option presented, predictions of enemy reaction, degree of mission accomplishment, and residual capacity of friendly and enemy units involved, expressed as a percentage of the total number of estimates.
	PREDICTION QUALITY	Number of predictions, expressed as percentage correct, not incorrect or incorrect.
	PREDICTION TIME	Median time from the making of an estimate to the end of the time covered by the associated predictions.
PLAN	TIME FROM DECISION	Median time taken to issue a directive after a decision has been made.
	CONSISTENCY	Number of assignments in implementing directives which do not contradict the assignment of the Commander's decision(s), expressed as a percentage of the total number of assignments in the directives.
	CLARITY	Number of directives not queried by recipients, expressed as a percentage of the total number of directives.

Report Measures

CATEGORY	TITLE	DEFINITION
REPORTS	MONITORING COMPLETENESS	Number of CIRs reported, expressed as a percentage of CIR items.
	MONITORING ACCURACY	Number of units reported on where reported data are within the desired accuracy window, expressed as a percentage of total units on which reports are submitted. The desired window may be specified by the command, by doctrine, or developed parametrically. Units are friendly and enemy units of interest.
	MONITORING TIMELINESS	Number of units reported on where reported data are within the desired time window, expressed as a percentage of the total number of units on which reports are submitted. The desired window may be specified by the command, by doctrine, or developed parametrically. Units are friendly and enemy units of interest.
	UNDERSTANDING COMPLETENESS	Number of understandings of the situation reported by the headquarters expressed as a percentage of the total number required to be reported.
	UNDERSTANDING QUALITY	Number of perceptions of the situation reported by the headquarters expressed as percentage correct, not incorrect, or incorrect.
	PREDICTION COMPLETENESS	Number of estimates reported that include, for each option presented, predictions of enemy reaction, degree of mission accomplishment, and residual capacity of friendly and enemy units involved, expressed as a percentage of the total number of reported estimates.
	PREDICTION QUALITY	Number of reported predictions, expressed as percentage correct, not incorrect, or incorrect.
	INFORMATION NOT QUERIED	Number of information reports not queried by recipients, expressed as a percentage of the total number of information reports.

Report Measures (Continued)

CATEGORY	TITLE	DEFINITION
COORDINATION	MONITORING COMPARABILITY	Number of cases where cells in a node agree on similar data elements concerning monitored units expressed as a percentage of all such data elements in the network. Similar data elements are like elements concerning like units observed at the same time; agreement does not exist if a data element at any one node is at variance with one for any other node at a given time.
	UNDERSTANDING COMPARABILITY	Number of cases where cells in a node agree on understanding of the comparable friendly and enemy situations, expressed as a percentage of all such understandings in the network.
	RESPONSE TIME	Median time used to complete the coordination cycle. The time is measured from a cell's perception of the necessity for coordination until a request or report is received.
	REQUEST TIME	Median time taken to issue a request or report after a decision has been made.
	NOT QUERIED	Number of coordination requests and reports not queried by recipients, expressed as a percentage of the total number of requests and reports.
	TIMELINESS	Number of queries responded to within the desired time window, expressed as a percentage of the total number of queries. The desired time window will be specified by the originator of the query.

Network Measures

CATEGORY	TITLE	DEFINITION
NETWORK	CONFIGURATION	Number of nodes correctly identified, expressed as a percentage of total nodes in the network (actual and perceived).
	PLANNING COMPARABILITY	Number of periods of operation as alternate and backup nodes with no conflicting assignments expressed as a percentage of total periods of operation as alternate or backup nodes. For alternate and backup nodes, this is a measure of the currency of information compared with that held at the primary; the capability to perform the function of primary with no degradation of own functions; and the existence of conflicting assignments.
	MONITORING COMPARABILITY	Number of cases where cells in a node agree on similar data elements concerning monitored units expressed as a percentage of all such data elements in the network. Similar data elements are like elements concerning like units observed at the same time; agreement does not exist if a data element at any one node is at variance with one for any other node at a given time.
	UNDERSTANDING COMPARABILITY	Number of cases where cells in a node agree on understandings of the comparable friendly and enemy situations, expressed as a percentage of all such understandings in the network.
	UNDERSTANDING QUERIES	Number of attempts made to implement a headquarters decision in which differences in perception about own force situation do not cause queries, expressed as a percentage of total attempts.

Network Measures (Continued)

CATEGORY	TITLE	DEFINITION
	DIRECTIVE COMPARABILITY	Number of directives and/or guidance issued by alternate and/or backup nodes when assuming control which are not redundant and do not conflict with existing directions. Expressed as a percentage of the total number of directives issued by an alternate or backup nodes when assuming control.

APPENDIX B

Exercise and Scenario Descriptive Measures

CATEGORY xE : EXERCISE CONTROL MEASURES

TITLE	TECHNICAL DEFINITION	COMPUTATION	OPERATIONAL DEFINITION
EXERCISE ENVIRONMENT AUTHENTICITY	AE.1.0 The degree of reality in the exercise environment.	1=artificial 2=command post exercise (CPX) 3=field exercise (FX) 4=combat or crisis	
EXERCISE PERIOD	AE.2.0 The period within the exercise.	dates of the exercise	It is intended that this measure have the potential for quarter-day or half-day detail.
Operational Phase of the Exercise	AE.2.1 The phase of progression through the exercise.	1=beginning of exercise (STARTEX) 2=initial contact 3=defense/offense 4=end of exercise (ENDEX)	
HIGHER HQ REPRESENTATION	AE.3.0 How completely is the higher HQ staff represented ?	1=entirely by computer simulation 2=by less than full staff but computer-assisted 3=by less than full staff without computer enhancement 4=by full staff	
Adjacent HQ Representation	AE.3.1 How completely are adjacent HQs represented?	1=entirely by computer simulation 2=by less than full staff but computer-assisted 3=by less than full staff without computer enhancement 4=by full staff	
UNIT EXPERIENCE	UE.1.0 Has unit been employed in combat or in a crisis situation within the last 24 months ?	1=yes 0=no	

CATEGORY xE : EXERCISE CONTROL MEASURES

Unit Time in Field	UE.1.1 How much time has the spent in the field in the last 24 months ?	time in months	
Unit Time Out of Action	UE.1.2 How long has it been since the unit was last in action, either real or FTX ?	time in months	
UNIT ECHELON	UE.2.0 At what echelon is this unit ?	1=brigade 2=division 3=corps	
UNIT TYPE	UE.3.0 What is the nature of the unit ?	1=light infantry 2=mechanized infantry 3=armor	
EXTENDED STAFF SIZE	UE.4.0 What is the size of the extended staff?	number of staff members in extended staff	The extended staff is defined as the staff reporting to the commander, the assistant commanders, the chief of staff and the principal general and special staff members.
Extended Staff to TO&E Ratio	UE.4.1 What is the ratio of extended staff to the staff TO&E?	number of staff members in extended staff -------------------------------- number of staff found in TO&E	
Extended Staff Time with Unit	UE.4.2 The median time with unit of extended staff members.	number of months with unit	
Extended Staff Time in Position	UE.4.3 The median time in current staff position of extended staff members.	number of months in position	
IMMEDIATE STAFF SIZE	UE.5.0 What is the size of the immediate staff ?	number of staff members in immediate staff	The immediate staff is defined as the assistant commanders, the chief of staff and the principal general and special staff members.

CATEGORY xE : EXERCISE CONTROL MEASURES

Immediate Staff to TO&E Ratio	UE.5.1 What is the ratio of immediate staff to the staff TO&E?	$\dfrac{\text{number of staff members in immediate staff}}{\text{number of staff found in TO\&E}}$
Immediate Staff Time with Unit	UE.5.2 The median time with unit of immediate staff members.	number of months with unit
Immediate Staff Time in Position	UE.5.3 The median time in current staff position of immediate staff members.	number of months in position
UNIT C2 AUTOMATION	UE.6.0 Communications and automated C2 support systems available to unit.	1=Maneuver (MCS) 2=Air Defense (FAAD C3I) 3=Combat Service Support (CSSCS) 4=Fire Support (AFATDS) 5=Intelligence (ASAS) 6= Army Data Distribution System (ADDS) 7= Multiple Subscriber Equipment (MSE) 8=Single Integrated Circuit Ground to Air Radio System (SINCGARS)
WEATHER IMPACT ON EXERCISE	EE.1.0 Weather which affected the exercise.	1=rain 2=snow 3=fog 4=mud 5=sand 6=extreme high or low temperature 7=other (specify)

CATEGORY xE : EXERCISE CONTROL MEASURES

TERRAIN IMPACT ON EXERCISE	EE.2.0 Terrain which affected the exercise.	1=jungle/forest 2=desert 3=mountain 4=urban 5=wetland/swamp 6=combination of above (specify) 7=other (specify)
HABITABILITY	EE.3.0 The type of unit accommodations available.	1=fixed barracks 2=field conditions
EXERCISE WORKLOAD	EE.4.0 The longest span of continuous participation without rest for principal participants.	number of hours of participation without rest
Exercise Shifts	EE.4.1 The shift length for principal participants.	length of shift in hours
Exercise Overtime	EE.4.2 Percentage of principal participants working longer shifts than exercise norm.	number of principal participants working longer shifts ---------------------------------- total principal participants
COMBAT INTENSITY	EE.5.0 Purpose, extent and composition of exercise.	1=low intensity conflict 2=mid-intensity combat 3=high intensity combat
EXERCISE UNCERTAINTY	EE.6.0 Unit's degree of familiarity with scenario elements.	1=two or more "quite" 2=at least three "somewhat" 3=at least two "not"
Scenario Uncertainty	EE.6.1 Unit's degree of familiarity with exercise scenario-type.	1=quite 2=somewhat 3=not
Terrain Uncertainty	EE.6.2 Unit's degree of familiarity with exercise terrain.	1=quite 2=somewhat 3=not

CATEGORY xE : EXERCISE CONTROL MEASURES

Enemy Force Uncertainty	EE.6.3 Unit's degree of familiarity with enemy forces.	1=quite 2=somewhat 3=not	
Own Force Uncertainty	EE.6.4 Unit's degree of familiarity with friendly forces.	1=quite 2=somewhat 3=not	
PACE OF EXERCISE	EE.7.0 Relative frequency of events creating new military situations.	number of decisions per exercise day	
THREAT ENVIRONMENT IN EXERCISE	EE.8.0 Combined measure of enemy threat in which unit operates during exercise day.	1=low threat 2=medium threat 3=high threat	High threat environments are those where the force ratio is less than 2:1 in Blue's favor and the enemy has at least 5 (combat aircraft) on the sophistication scale and at least chemical or biological weapons. Moderate threat environments are those where the force ratio is less than 3:1 in Blue's favor and the enemy has at least 3 (armor) on the Sophistication scale and conventional weapons. Low threat environments are those below the moderate definitions.
Force Ratio Threat	EE.8.1 Ratio of enemy forces to friendly forces.	$\frac{\text{measure of enemy force}}{\text{corresponding measure of friendly force}}$	Force ratio threat will be computed in division equivalents.
Sophistication of Enemy Systems	EE.8.2 On a relative scale, the most sophisticated equipment employed by enemy forces.	1=small arms 2=crew-served weapons 3=armor 4=helicopters 5=aircraft 6=surface to surface missiles (SSMs) 7=electronic warfare	

Toxicity of Enemy Weapons	EE.8.3 On a relative scale, the most toxic weapons used by enemy forces.	0=conventional weapons 1=chemical weapons 2=biological weapons 3=nuclear weapons 4=combinations of the above (specify)

APPENDIX C

Outline of POI for Training ACCES Observers

Army Command and Control System (ACCES)
Program of Instruction (POI)

Overview. The ACCES POI was developed to train and enhance performances of individuals serving as Data Collectors using the ACCES methodology. This activity is normally conducted in Army command posts. The POI consists of the 14 lessons.

Lesson #	Lesson Title	Duration
1A	What is ACCES?	30 minutes
1B	What is Army C2?	60 minutes
1C	What Does the ACCES Team Do?	15 minutes
2A	Recognition Skills	90 minutes
2B	Recording Skills	60 minutes
2C	Data Reduction	90 minutes
2D	Strategies for Effective Data Collection	60 minutes
4A	Division Organization for Combat	90 minutes
5A	Tactical Exercise Overview	105 minutes
5B	ACCES Observer Critical Events	15 minutes
6A	Assessment Methodology	30 minutes
6B	Practical Exercise	210 minutes
6C	ACCES Preparation	50 minutes
7	Data Reduction Refresher	60 minutes

Table 1. Summary of ACCES Observer Training Lessons

The training audience must enter the field setting with knowledge of Army command and control doctrine, organization and functions of brigade, division or corps staffs, and ACCES data element definitions. A typical trainee will have experience with military operations.

The primary method of instruction is the lecture that is augmented by hands-on practical exercises that allow the students to observe command post activities and record their observations. The instruction is supplemented by student handout materials. Learning is reinforced through instructor feedback, scoring of practical exercises and classroom discussions.

Lesson Title: ACCES Application- What Is the Army Command and Control Evaluation System (ACCES)?

Purpose: This lesson will provide the observers with an understanding of Army Command and Control Evaluation System (ACCES), its use as a measurement methodology and its purpose.

Time for Completion: 30 Minutes

Learning Objective:

Task: Identify the components of the ACCES methodology.

Condition: Given the ACCES Handbook, FM 100-5, Operations, and FM 101-5, Staff Organization and Operations.

Standard: Each observer and analyst will correctly recognize and categorize command and control behaviors. The student will identify the roles and functions of command and staff cells within a command post. A self-reported quiz will be used to determine whether the student is familiar with the content.

Lesson Title: ACCES Application- What Is Command and Control?

Purpose: This lesson will provide the observers with an understanding of Army Command and Control (C2) process, its doctrinal foundation and its relationship to AirLand Battle. It is intended as an introduction to a broad category of information found in unit SOPs, Army Field Manuals in particular FM 100-5 Operations, FM 101-5, Staff Organization and Operations, FM 71-100, The Division and FM 100-15, Corps Operations. A C2 student handout is provided to supplement the instruction.

Time for Completion: 60 Minutes

Learning Objective:

Task: The observer or analyst will recognize the responsibilities of recognition, recording, data reduction, analysis and reporting, He or she will have a basic understanding of the roles of observer and analyst, the responsibilities of each, and how they work together.

Condition: Given the C2 references and this lesson.

Standard: Each observer and analyst will correctly recognize and categorize command and control behaviors. The student will identify the roles and functions of command and staff cells within a command post. A self-reported quiz will be used to determine whether the student is familiar with the content.

Lesson Title: ACCES Application- What Does the ACCES Team Do?

Purpose: This lesson will provide the observers with an introduction to the roles and responsibilities of the ACCES team. This introduction orients the attention of the observers for the remaining units of training.

Time for Completion: 15 Minutes

Learning Objective:

Task: The observer or analyst will recognize the responsibilities of recognition, recording, data reduction, analysis and reporting, He or she will have a basic understanding of the roles of observer and analyst, the responsibilities of each, and how they work together.

Condition: Given the ACCES handbook and this lesson.

Standard: Each observer and analyst will correctly identify all five of the major responsibilities and whether the responsibility is assigned to the observer role or analyst role. The student will correctly identify when the roles must cooperate to carry out a responsibility. A quiz will be used to determine if the student has been properly oriented.

Lesson Title: ACCES Application- Recognition Skills

Purpose: This lesson will introduce the student to the skills used to recognize and collect ACCES data elements. Critical skills will be highlighted in discussions and practical exercises designed to provide trainees with command post-like experience.

Time for Completion: 90 Minutes

Learning Objective:

Task: Discriminate those data sources e.g., events, documents and key personnel, which provide data needed to complete ACCES data reduction forms.

Condition: Given the ACCES Handbook and the lesson content.

Standard: Each observer will be able to reliably discriminate from a list of data sources the primary data sources within the training setting in at least 95% of the cases.

Lesson Title: ACCES Application- Recording Skills

Purpose: This lesson teaches the observer to accurately and completely record the data of interest from an exercise into a journal. There are two sources of data in an exercise: 1) exercise generated documents or other physical records, and 2) events which are observed. The observer must first know how to recognize the documents and the events of importance in a training exercise. Then, the observer must be able to select the data of interest and record that data in a journal. Observers participating in this lesson must already know how to recognize events and documents. This lesson will highlight the associated data elements and will provide the observer with an understanding of and practice in the skills needed to maintain a chronological journal. Each trainee will practice recording skills by observing a video tape of a command post briefing.

Time for completion: 60 minutes

Learning Objectives

Task: Select and record the data elements associated with a given document or event accurately and completely including recording of time.

Condition: Given proficiency in recognizing the documents and events and, given familiarity with the associated data elements.

Standard: The observers will each complete a data collection journal that will be scored by the instructor.

Lesson Title: ACCES Application- Data Reduction

Purpose: The lesson will provide the observer with an understanding of and practice in the skills needed to properly transfer the data elements from a chronological journal to data reduction forms. This lesson will provide the observer with an opportunity to practice transferring some of the data elements. The trainee will use his data collection journal results from the previous practical exercise to practice data reduction skills.

Time for completion: 90 minutes.

Learning Objective:

Task: Select and record the data elements associated with a given document or event from a chronological journal onto data reduction forms accurately, completely and consistently.

Condition: Given familiarity with the schemata of measures; given proficiency in recognizing the documents and events; given completed journal examples; and, given practice in transferring.

Standard: The observers will each have attained practice in completely filling out one data reduction form.

Lesson Title: ACCES Application- Strategies for Effective Data Collection

Purpose: The lesson will provide the observer with a discussion of effective data collection strategies. Emphasis will be placed on the need to collect complete, accurate information, and to provide continuity between shifts. The most difficult ACCES measures to be observed and collected will be illustrated in practical exercises. Observers will be shown how they are part of a network of observers who provide valuable insights that are integrated by analysts to produce a composite of the unit's command and control performance.

Time for completion: 60 minutes.

Learning Objective:

Task: Learn the behaviors that lead to maintaining complete, accurate and valid data including effective shift handover procedures.

Condition: Given familiarity with the sources of data e.g., documents, events, key personnel, the ACCES Handbook, command post operations and the lesson content

Standard: The observers will recognize potential data collection pitfalls, and can describe compensating strategies to achieve greater reliability and accuracy.

Lesson Title: ACCES Application- Division Organization for Combat

Purpose: The lesson will provide the observer with a basic understanding of the U. S. Army Division, its organization, the Battlefield Operating Systems (BOSs), the doctrinal staff structure, and its command post configurations.

Time for completion: 90 minutes.

Learning Objective:

Task: Identify the types of U. S. Army divisions and their basic organizations, and the structure for command and control of current operations.

Condition: Given FM and TC 101-5, Staff Organization and Operations.

Standard: The observers will achieve 85% on a criterion referenced post test.

Task: Identify the Battlefield Operating Systems (BOSs).

Condition: Given FM 71-100, The Division.

Standard: The observers will achieve 85% on a criterion referenced post test.

Task: Identify the command and staff functions performed at each of the type command posts.

Condition: Given FM and TC 101-5, Staff Organization and Operations; and FM 71-100, The Division.

Standard: The observers will achieve 85% on a criterion referenced post test.

Lesson Title: ACCES Application- Tactical Exercise Overview:

Purpose: The lesson will provide the observers with an understanding of the exercise scenario and unit training objectives for the particular event being observed. The ACCES methodology may be applied to a training exercise or to an event where there are experimentation or assessment objectives, but no training objectives. Whatever the objectives of the event, they will provide a framework for the observations and for the analysis and feedback.

Time for completion: 105 minutes

Learning Objective:

Task: Understand the nature of the training objectives and how that will help focus observation, analysis and feedback.

Condition: Given the exercise Master Events/Incident List and the friendly and enemy situation

Standard: The observer will be familiar with the STARTEX situation to include OPLAN, FRAGOs, disposition of forces and area of operations and be able to recognize the representation of these factors when presented in a military briefing or on a situation map (SITMAP).

Lesson Title: ACCES Application- ACCES Observer Critical Events

Purpose: The lesson will provide the observers with an opportunity to discuss the exercise scenario and unit training objectives in order to forecast critical events.

Time for completion: 15 minutes

Learning Objective:

Task: Understand the nature of the critical events and their relationship to the unit's planning and decision cycle.

Condition: Given the exercise Master Events/Incident List and the friendly and enemy situation

Standard: The observer will be familiar with the STARTEX situation to include OPLAN, FRAGOs, disposition of forces and area of operations and be able to recognize the representation of these factors when presented in a military briefing or on a situation map (SITMAP).

Lesson Title: ACCES Application-Assessment Methodology

Purpose: The lesson will provide the student with a capstone overview of the collection and analysis procedures for the Army Command and Control Evaluation System (ACCES). Each ACCES team member will see how he or she fits into the overall ACCES application and how their role is interdependent with other roles.

Time for completion: 30 minutes.

Learning Objective: This is a team building lesson.

Task: Relate observations to components of the ACCES model of Command and Control performance.

Condition: Given the ACCES Handbook , student notes and a working knowledge of the staff procedures and functions presented in FM 101-5, Staff Organization and Operations.

Standard: Observers will function as a team that reports reliable, accurate information on the correct data reduction form.

Lesson Title: ACCES Application-Practical Exercise

Purpose: The practical exercise will provide experience for the observers by simulating some of their duties in an exercise. The practical exercise includes four distinct phases which will address recognition, recording observation, and data reduction from journals to data reduction forms.

Time for completion: 3.5 hours

Learning Objective: Team Building

Task: To field a proficient team of ACCES observers.

Condition: Given the instruction and data collection materials

Standard: Observe,collect, record and report the data needed to complete ACCES data reduction forms accurately and reliably.

Lesson Title: ACCES Application-Preparation for an Exercise

Purpose: This lesson reinforces the training and transitions the team into final preparation for the exercise. This part of the training will focus on assembly of materials, providing advance materials and coaching the team member on what to read and why. It gives the instructor a final opportunity to check on access to the facilities and to walk through the final schedule for observation. Arrangements can be made at this time for a visit to the CP for each observer and introductions of the observers to the staff.

Time for completion: 50 minutes

Learning Objective: Team Building

Task: Each observer and analyst will demonstrate that they understand the schedule, will demonstrate that they have the necessary supplies to begin their job, will be oriented to the physical setting, and will read information available in advance such as orders. Each observer will visit the CP and meet staff officers.

Condition: Given an ACCES handbook, ACCES training, maps of the exercise location, schedules, unit documentation, appointment with the CP assigned, and availability of supplies and job aids (such as map reading prompts or ensignia reading prompts).

Standard: Every analyst and observer will have all supplies and will be able to describe their expected schedule and work locations.

Lesson Title: Data Reduction Refresher Training

Purpose: This lesson provides the ACCES Team with refresher training needed to enhance data reduction skills following the unit training exercise. It is delivered prior to the reduction of data collected during the exercise.

Time for completion: 60 minutes

Learning Objective:

Task: Develop a key events timeline and establish the process for completing data reduction forms.

Condition: Given an ACCES handbook, the data collectors journals and data reduction sheets.

Standard: Reliable accurate data reduction sheets

APPENDIX D

ACCES Data-Reduction Forms: version 91.3

GENERAL MEASURES (G):

Observer: ______________________ Date-time-group: ______________

DTAC ☐ DMAIN ☐ DREAR ☐ BRIGADE ______________

Who had primary responsibility for developing this plan? | Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐ Fire Support ☐ Plans ☐ Special Staff ☐

Plan ID: [Name and/or number] Implementing Directive(s): ______________

This plan relates to the following decision(s): ______________

PLAN

Time Planning Began: ______________ Time Planning was Complete ______________

Total Staff Planning Time: ______________ Total C2 Planning Cycle Time: [Requires data from related Decision forms]

Time Plan to be Implemented: ______________ Time Plan Expected to End: ______________

Total Intended Plan Life: ______________ Actual Plan End: ______________ Plan Duration: ______________

PLAN Elements \ TIMES [See Note A.]	First Established	Change Implemented per this Plan	Intended Duration	Actual Duration
Mission	[See Note B]			
Task Org.				
Schedules				
Boundaries				

Note A: Only those Plan elements which are changed by the current plan are recorded here.
Note B: Record the time each Plan element was implemented and the ID of the plan which originally established that element.

PLAN SUCCESS : DOMINANT ☐ ADAPTIVE ☐ UNSUCCESSFUL ☐

PLAN INITIATIVE: PROACTIVE ☐ CONTINGENT ☐ REACTIVE ☐

PLAN STRESS: LOW ☐ MODERATE ☐ HIGH ☐

PRIOR PLANNING CYCLE WAS : DOMINANT ☐ ADAPTIVE ☐ UNSUCCESSFUL ☐

ACCES 91.3

INFORMATION HANDLING MEASURES (IH)

Observer: ____________________ Date-time-group: ____________________

DTAC ☐ DMAIN ☐ DREAR☐ BRIGADE ____________________

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐

Fire Support ☐ Plans ☐ Special Staff ☐

INCOMING ☐

OUTGOING ☐

TO:____________________

FROM:____________________

FRIENDLY STATUS REPORT ☐

ENEMY INTELLIGENCE SUMMARY (INTSUM) ☐

FRIENDLY SPOT REPORT ☐

ENEMY SPOT REPORT ☐

WEATHER AND TERRAIN REPORT ☐

Time Report Is Due:____________________

Time Report Is Received:____________________

Time Report Was Sent:____________________

Time Of Stimulus:____________________

Time Stimulus Perceived:____________________

Time Evaluated:____________________

Source Of Data In Report:______
[Maps, lower echelon spot reports, etc.]

Was The Report Complete? (Did It contain the following...)		Was Any Of The Information Questioned? Queries For Clarification?
Unit ID	☐	☐
Unit Location	☐	☐
Capability	☐	☐
Combat Activity	☐	☐

Time Of Oldest Report Element:____________

MEDIUM OF TRANSMISSION:

FM ☐ MSE ☐ FAX ☐ BRIEF ☐ COURIER ☐ MCS ☐

Other Related Data Sheets____________________

ACCES 91.3

IH-2 SUPPORTING INFORMATION HANDING FORM

Observer:_______________________________

☐ DMAIN ☐ DTAC ☐ DREAR ☐ ______BDE

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐

Fire Support ☐ Plans ☐ Special Staff ☐

	FIELD OBSERVER			GROUND TRUTH			
TIME of OBS							
"AS OF" TIME							
UNIT	LOCATION	CBT PWR	ACT	UNIT	LOCATION	CBT PWR	ACT

[Annotate any information elements which were queried.]

Number of outgoing reports:
Made this period ______________ (a)
Queried by recipients ______________ (b)
Not queried (a-b) ______________ (c)

TRACKING THE SITUATION MEASURES (T):

Observer:________________ Date -time-group________________

DTAC ☐ DMAIN ☐ DREAR ☐ BRIGADE ________________

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐
Fire Support ☐ Plans ☐ Special Staff ☐

Situation Assessment: FORMAL ☐ INFORMAL ☐

Type Of Formal/Informal Briefing:________________________________

Time Assessment Expressed: ____________ By Whom: ______________________

Briefly Describe The Assessment ______________________________________

____

ASSESSMENT DEALT WITH:

Friendly Force:

- ☐ Mission
- ☐ Task Organization
- ☐ Disposition
- ☐ Activity
- ☐ Status
- ☐ Support

Enemy Force:

- ☐ Combat Power
- ☐ Composition
- ☐ Disposition
- ☐ Activity
- ☐ Courses Of Action

Were Other Situation Assessments Considered Possible? Yes ☐ No ☐

Other Possibilities Were______________________________________

____

____

This Situation Assessment Covers The Current And Expected Situation
Up To Time____________________

This Situation Assessment Contributed To A Decision At Time____________

Other Related Data Sheets:______________________________

ANALYST USE ONLY

Assessment Was: Correct ☐ Incorrect ☐ Cannot be determined ☐

ACCES 91.3

INFORMATION COORDINATION MEASURES (IC):

Observer:______________ Date-time-group______________

DTAC ☐ DMAIN ☐ DREAR ☐ BRIGADE ______________

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐
Fire Support ☐ Plans ☐ Special Staff ☐

This Concerns Coordination:

Within a CP ☐ **Between CPs** ☐

[Note: Coordination is _not_ the same as an information request. When "coordinating", the initiator will request _input_ or _comments_, not just information.]

Time:

Time Need To Coordinate Perceived______________

Describe the Issue or Action: ______________

This Coordination Deals With Personnel ☐ Operations ☐
Intelligence ☐ Logistics ☐

Coordination Request From: ______________

Request Sent TO:	Time Request Initiated	Time Response Received

COORDINATION REQUEST SENT VIA:

FM ☐ MSE ☐ FAX ☐ FACE-TO-FACE ☐ COURIER ☐ MCS ☐

Other Related Data Sheets______________

ANALYST USE ONLY

This Action Was : Timely ☐ Untimely ☐

ACCES 91.3

Course of Action Measures (COA):

Observer:________________ Date-time-group________________

DTAC ☐ DMAIN ☐ DREAR ☐ BRIGADE ________________

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐
Fire Support ☐ Plans ☐ Special Staff ☐

Which elements were discussed?

Plan Courses Of Action:

COAs Considered:
(Circle # of COA Selected)

	Enemy Reaction	Mission Accomplishment	Friendly Capacity	Enemy Capacity
1.________________	☐	☐	☐	☐
2.________________	☐	☐	☐	☐
3.________________	☐	☐	☐	☐
4.________________	☐	☐	☐	☐
5.________________	☐	☐	☐	☐
6.________________	☐	☐	☐	☐

Number Of COAs Evaluated: ________________

Time Selected COA Was Completed____________

How Far Does It Look Into The Future? __________

Staff:

Number Of Members Involved COA Analysis: ________________
Number Of Cells Involved In COA Analysis: ________________

Other Related Data Sheets:________________________

ANALYST USE ONLY

Actual Prediction Was: Correct ☐ Incorrect ☐ Cannot be Determined ☐

ACCES 91.3

PREPARATION OF DIRECTIVES MEASURES (PD):

Observer:________________ Date -time-group________________

DTAC ☐ DMAIN ☐ DREAR ☐ BRIGADE ________________

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐

Fire Support ☐ Plans ☐ Special Staff ☐

Type of Directive: Warning Order ☐ FRAGO ☐ VERBAL ORDER ☐

The Order/Directive changed or established:

Missions ☐ Task Organization ☐ Schedules ☐ Boundaries ☐

The Order/Directive deals with:

Personnel ☐ Operations ☐ Intelligence ☐ Logistics ☐

DESCRIBE the context and content: ________________________________

____

Was this Directive based on an earlier Decision and/or Plan? Ref: ________________

If not, who made the decision? Under what circumstances? ________________

____

Was Directive Consistent With Decision Maker's Intent? Yes ☐ No ☐

If Not, Which Elements Were Inconsistent:

Missions ☐ Task Organization ☐ Schedules ☐ Boundaries ☐

Time First Element Supposed To Begin Execution________________

Time Expected To Be Completed________________

Time Preparation Started At This CP________________
Time Preparation Stopped At This CP________________

Time Directive Issued________________

Time Directive Received By Subordinate Commands________________
(Separate Individual times by commas)

ACCES 91.3

DECISION CONTEXT MEASURES (DC):

Observer:______________ Date-time-group______________

DTAC ☐ DMAIN ☐ DREAR ☐ BRIGADE ______________

Current Ops ☐ Command ☐ Intelligence ☐ CSS ☐

Fire Support ☐ Plans ☐ Special Staff ☐

Identification Of Directive (Date-time-group):______________

What Was the Decision?______________

What Time Was the Decision Made?______________

Stimulus For Decision:______________

Time Of Stimulus:______________ Time Perceived At CP:______________

What Officer Made the Decision?

Commander ☐

Subordinate In Commander's Name ☐

Assitant Division Commander ☐

Chief Of Staff or Executive Officer ☐

G-3/S-3 ☐ G-2/S-2 ☐ G-4/S-4 ☐

Other__________ Unknown ☐

What Unit(s) Were Affected?______________

What Elements did the Decision concern?

Mission ☐ Task Organization ☐ Unknown ☐

Support ☐ Schedules ☐ Boundaries ☐

Other__________

Was A Contingency Activated? Yes ☐ No ☐

If Yes, Title or other Id of the Contingency:______________

Type Of Operation (as per attached list):______________

Other Related Data Sheets:______________

ACCES 91.3

EXERCISE CONTROL MEASURES (xE):

Observer:

Sim Center ______________________ Other ______________________

EXERCISE ENVIRONMENT AUTHENTICITY:

DEGREE OF REALITY:
- ☐ ARTIFICIAL
- ☐ COMMAND POST EXERCISE
- ☐ FIELD EXERCISE
- ☐ COMBAT OR CRISIS

EXERCISE PERIOD:

DATES OF THE EXERCISE? ______________

WHAT WAS THE PHASE PROGRESSION (DATE-TIME- BOUNDARIES) ?

BEGINNING OF EXERCISE (STARTEX)__________

INITIAL CONTACT:________________

DEFENSE / OFFENSE:______________

END OF EXERCISE (ENDEX):__________

HOW WAS THE HIGHER HQ STAFF REPRESENTED?
- ☐ ENTIRELY BY COMPUTER SIMULATION
- ☐ LESS THAN FULL STAFF BUT COMPUTER ASSISTED
- ☐ LESS THAN FULL STAFF AND NO COMPUTER ENHANCEMENT
- ☐ BY FULL STAFF

HOW WAS THE ADJACENT HQ STAFF REPRESENTED?
- ☐ ENTIRELY BY COMPUTER SIMULATION
- ☐ LESS THAN FULL STAFF BUT COMPUTER ASSISTED
- ☐ LESS THAN FULL STAFF AND NO COMPUTER ENHANCEMENT
- ☐ BY FULL STAFF

TERRAIN:

JUNGLE/FOREST ☐ WETLAND/SWAMP ☐ DESERT ☐

MOUNTAIN ☐ URBAN ☐

COMBINATION______________ OTHER__________________

UNIT EXPERIENCE:

HAS THE UNIT BEEN INVOLVED IN A COMBAT / CRISIS SITUATION WITHIN THE LAST 12 MONTHS? YES ☐ NO ☐

UNIT EXPERIENCE cont.: ACCES 91.3

INTENSITY OF CONFLICT IN SCENARIO IS HIGH ☐ MEDIUM ☐ LOW ☐

DECISIONS PER HOUR OF EXERCISE_______________

IS THE UNIT FAMILIAR WITH :

EXERCISE SCENARIO	QUITE ☐	SOMEWHAT ☐	NOT ☐
EXERCISE TERRAIN	QUITE ☐	SOMEWHAT ☐	NOT ☐
OPPOSING FORCES	QUITE ☐	SOMEWHAT ☐	NOT ☐
FRIENDLY FORCES	QUITE ☐	SOMEWHAT ☐	NOT ☐

WHAT IS THE RATIO OF ENEMY TO FRIENDLY FORCES (IN DIVISION EQUIVALENTSAT EXERCISE INITIATION?_______________

WHAT IS THE MOST SOPHISTICATED ENEMY COMBAT SYSTEM?

- SMALL ARMS (1) ☐
- CREW-SERVED WEAPONS (2) ☐
- ARMOR (3) ☐
- HELICOPTERS (4) ☐
- AIRCRAFT (5) ☐
- SURFACE TO SURFACE MISSLE (SSMS) (6) ☐
- ELECTRONIC WARFARE CAPABILITY (7) ☐

WHAT ARE THE MOST TOXIC WEAPONS USED BY THE ENEMY?

CONVENTIONAL (0) ☐	BIOLOGICAL (2) ☐
CHEMICAL (1) ☐	NUCLEAR (3) ☐

COMBINATION OF THE ABOVE (4) (SPECIFY)_______________

NOTES :

Working Paper

WP LVN-88-5

RESERVE COMPONENT INSTRUCTIONAL INFORMATION MANAGEMENT SYSTEM
(RCIIMS)

TEST AND EVALUATION PLAN

by

Dr. Ernest Lowden
Chief, Office of Evaluation and Standardization
Command and General Staff College, Fort Leavenworth, KS

Dr. Delane Garlinger
Research Psychologist
Army Research Institute, Fort Leavenworth, KS

LTC James S. Cary
Office of the Chief of Staff, Army
The Pentagon, Washington, D.C.

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333

20 June 1988

PREFACE

In May 1988, a Memorandum of Understanding was signed between the Office of the Chief of Staff, Army, the Command and General Staff College, and the Army Research Institute. This Memorandum initiated a research project to examine the effectiveness of an educational technology package consisting of video teleconferencing, computer conferencing, and audio teleconferencing. These three media as a delivery means are to be assessed and compared with two other instructional alternatives.

This document entitled "Research Component Instructional Information Management System (RCIIMS) Test and Evaluation Plan" is intended to provide a detailed description of the methodology planned for this study.

RESERVE COMPONENT INSTRUCTIONAL INFORMATION MANAGEMENT SYSTEM (RCIIMS)

TEST AND EVALUATION PLAN

CONTENTS

RESERVE COMPONENT INSTRUCTIONAL INFORMATION SYSTEM
(RCIIMS)

TEST AND EVALUATION PLAN

1. Task Description.

a. Purpose. The purpose of this evaluation plan is to form the basis for a logical, efficient, and economical approach to determining the training effectiveness and cost effectiveness of the combination of interactive video, enhanced audio conferencing, and computer-based teleconferencing. These three media as a delivery means will be assessed and compared with two other instructional alternatives:

(1) Nonresident instruction (RF option).

(2) Correspondence (nonresident) courses.

b. Concept. In order to provide factual data to support the finds made during the course of this evaluation it will be necessary to complete five primary and concurrent actions:

(1) Measure the training effectiveness of these media and compare those results with the findings of previous research and then compare the training effectiveness results with the training of like, competitive course as indicated in paragraphs a. (1)-(2) above.

(2) Measure IAW the Systems Approach to Training (SAT) the cost effectiveness of RCIIMS and compare the results with the findings for student hourly costs for the competitive courses referred to in paragraph a. (1)-(2) above.

(3) Relate both the training effectiveness and the cost effectiveness by means of a measure of efficiency wherein cost versus efficiency can be analyzed.

(4) Extrapolate to an "assumed" mature and fully operational RCIIMS to compensate for its present cost and applications. Additionally, it is envisioned that all applicable findings other than those cited above will be used in the final report of this Task as appropriate.

2. Test Evaluation Methodology.

a. General Information.

(1) The purpose of the methodology section is to describe the environment, experimental design and procedures to evaluate the RCIIMS. This evaluation is considered a Field Experiment. It will be conducted in a realistic training environment, under the conditions and with the population that would normally be involved in the methods of instruction being evaluated in this study.

(2) The reasons for selection and advantages of conducting a Field Experiment of this nature are:

(a) The investigator manipulates or controls the independent variable (method of instruction).

(b) The study is conducted in realistic setting under realistic conditions.

(c) The experimenter controls the research setting allowing the independent variables effect to be accurately assessed.

(d) The design allows a stronger inference, than allowed by ex post factor research, to be made about the relationship between the variables under study. (Davis and Cosenza, 1985).

b. Nature and Purpose.

(1) This evaluation will employ a single-factor, three group design to assess the effectiveness of an educational technology package consisting of interactive video, enhanced audio conferencing and computer based teleconferencing. This technology package will be compared to non-resident instruction conducted by RF Schools during ADT periods and correspondence instruction. The three instructional methods will be compared for effectiveness by analysis of differences between groups on outcome measures after controlling for differences between groups on initial proficiency.

(2) The evaluation model will also incorporate cost related data to determine a measure of cost per student hour. This measure will be calculated by summing the total course costs (as determined by the model) and dividing by the sum of the total student population (actual or assumed by the model) multiplied by the sum of the student contact hours.

$$\frac{\sum \text{Course Costs}}{(\sum \text{Student})\ (\sum \text{Hours})} = \text{Cost per Student Hour}$$

c. Population. Students participating in the evaluation will consist of officers receiving CGSOC non-resident instruction. Additional student populations have yet to be determined. Demographic data will be collected on the student population to permit limited ex post facto data analysis for management applications.

(1) Experimental Group. A sample consisting of at least fifteen nonresident students per comparison group will receive the teleconferencing version of Phase II of the RC CGSOC.

(2) Control Group. A sample consisting of at least fifteen nonresident students per comparison group will receive the same phase CGSOC (RF option). A sample of CGSOC Corresponding Studies students will be used as an additional comparison group.

d. Sample Selection. For the purpose of this demonstration samples were selected on the basis of availability. Limits to availability was caused by identification of students in the teleconferencing test area and the administrative requirements to get students transferred from their initial point of assignment.

e. Evaluation Design. The RCIIMS Field Experiment will follow a three group, single factor design. The three training methods selected for comparison are (1) Interactive Video, Enhanced Audio Teleconferencing, and Computer-based Teleconferencing, (2) Live Resident Instruction, and (3) Army correspondence instruction.

(1) Student learning will be measured by two objective tests administered at completion of instruction. One test will be designed to assess learning at the recognition level and will consist of multiple choice test items. The second test will assess learning at the more complex recall level and will require students to provide short answers to test items.

(2) Since no opportunity exists for random assignment of students to groups, other measures must be taken to ascertain the beginning proficiency levels of the groups. A multiple-choice diagnostic test will be administered prior to start of instruction to ascertain initial group proficiency and used as a covariant in the data analysis to factor out any initial inequality of groups.

(3) The two tests administered as measures of learning at conclusion of instruction will be analyzed using a single factor, multivariate analysis of covariance. A multivariate approach will be used rather than univariate because the two dependent measures will certainly be correlated. Therefore examination of these measures using a univariate approach would analyze redundant variance and result in an inflated probability of statistical significance.

f. Diagnostic Test. An objective MC test will be administered prior to start of instruction. (Appendix A-1) This test is a modification of the Combat Skills Comprehensive Examination which is administered to resident CGSOC students at the beginning of the course. This test provides students with their knowledge level of basic tactics, soviet tactics, and command and control subjects. Reasonable knowledge of these areas is needed to enhance initial CGSOC instruction.

This test will be used to determine what knowledge the participants bring to this Field Experiment. It will not be used as a tool to make quality elimination decisions. For the purposes of this test, and instructors will not be given formal or informal feedback or test results.

g. Posttests. The test intended to measure recognition learning is the usual end-of-phase MC test, which is required for course completion. (Appendix A-2) This test has not been formally validated in terms of content or construct.

The second test is designed to measure recall learning and will be formally content and construct validated prior to use as a research instrument. (Appendix A-3) This test was constructed in such a manner as to reflect the weighting of an objective according to its complexity/importance.

h. Student Questionnaires. Student attitudinal and demographic data is an essential component of the evaluation process. (Appendix A-4) As described in the literature search, the audience composition and response to training is frequently one of the most significant factors influencing the degree of training effectiveness. As such, certain information on the audience background, and response to the course content and delivery should be factored into the evaluation methodology. The questionnaire, located at Appendix A-4, is comprised of 25 questions on the student background, evaluation of the course content and technical delivery. The questions are designed to lend themselves to further empirical study.

i. Technical Evaluation.

(1) Reliability. CGSOC uses criterion based instruction. These criteria use Bloom's taxonomy of the cognitive domain to determine levels of learning. Since objectives establish the criteria which a student must achieve for competency, questions are subjectively compared with the appropriate learning objective. The number of objectives in this course of instruction prohibit a valid statistical analysis of internal consistency reliability. Analysis of other forms of reliability, such as test - retest or alternate forms, could not be conducted due to the time constraint involved in preparing for this Field Experiment.

(2) Validity. Content validity means that in the subjective option of SME the tests measures the course objectives. Construct validity means the instrument measures what is claims to measure. The diagnostic test has been in common use long enough for content validity to have been established. The end-of-phase test has not gone through formal review procedures. However, the short answer outcome measure will be content validated prior to use as a research instrument. At conclusion of this study a comparison will be made of achievement on each test and a comparison between the two outcome measures. These tests should be highly correlated as ex-post facto proof of construct validity.

(3) Single-Factor Multivariate Analysis of Covariance. Single-factor Analysis of Covariance is a statistical hypothesis testing procedure which assesses the causal relationship between the one independent variable, teaching method, and one dependent variable (outcome measure) while controlling statistically for a third variable (covariant) which is know to influence the dependent variable. Since this evaluation will employ two dependent variables, a modification of this approach will be used, Single-factor Multivariate Analysis of Covariance. This approach takes into account that the presence of more than one dependent variable introduces the possibility of varying degrees of correlation between the dependent variables. Therefore, analyzing each dependent variable separately would increase the probability of spurious significance since some of the variance would be analyzed redundantly.

(4) Ex Post Facto Evaluations. While the primary purpose of this evaluation is to collect and analyze cost and training effectiveness data, valuable information can also be obtained by capturing and analyzing student response and demographic data. Student response data has direct applicability in identifying problem areas which may adversely impact on training effectiveness. By assigning categories of responses (creating nominal and ordinal scale data) student responses and demographic data can be empirically analyzed as required. Demographic data, such as age, educational level (civilian and military) and occupation, can be used when applying two-way or factorial ANOVA techniques to identify factors which may impact on training effectiveness. Ex post facto statistical applications are useful in providing additional management insight into the area being researched. However, it should be recognized that the generalizable or predictive value of these results is less than results obtained from the original statistical design data and should be used primarily as the basis for further inquiry and analysis.

3. <u>DELIVERABLE.</u> Documentation of Findings. A detailed Technical Report will be written for the OCSA which describes the study and its findings. The major areas to be included are:

a. Perception of the value of teleconferencing, in general,

b. Perception of the value of teleconferencing in administrative matters,

c. Perception of the value of teleconferencing as a educational medium,

d. Comparison of the objective tests used to measure performance between the experimental group and the control groups, and

e. Comprehensive literature review of the educational applications of teleconferencing media.

f. Detailed cost elements by functional area, e.g., manpower, facilities . . . , contained in the three competing training approaches, i.e., teleconferencing, correspondence, and in residence instruction. Compare those costs with the effectiveness of the approach and analyze those data comparing current classroom instruction and corresponding studies with telecommunication-based instruction.

g. Recommendations for practical implementation of the research findings.

4. Test Administration Requirements and Procedures.

a. Purpose. As described above certain requirements must be met in order to conduct the RCIIMS evaluation. As a Field Experiment it is also important to control the data collection effort to minimize confounding factors and increase the validity of the results.

b. Responsibilities.

(1) CGSC/ARI-Leavenworth.

(a) Develop schedule of training to be evaluated of the following:

(1) Interactive Video, Enhanced Audio Teleconferencing, and Computer-based Teleconferencing.

(2) Live Resident Training. (Second Army from Hattiesburg and First Army from Dover.)

(3) Correspondence Courses.

(b) Submit test instruments to OCSA NLT 10 working days prior to scheduling training date for verification of content validation and test construction.* Items to be forwarded include:

(1) Test Specification Sheet.

(2) Diagnostic Test.

(3) Post-test.

(c) Instructors Lesson Plan Outline or documentation showing course format and learning objectives. There is no requirement to submit the course script or text of the lesson plan.

(d) Conduct evaluation orientation OAW Evaluation Plan for OCSA and field site personnel involved in the evaluation.

(e) Ensure completed diagnostic, post-test and student questionnaires are analyzed following each training session being evaluated.

(1) Compile training sites pre and post-tests following each training session. Student Questionnaires will also be compiled following RCIIMS training session.

(2) Forward roster of test results and student questionnaires to ARI-Leavenworth, within two (2) working days of each training session.* The test roster should be ordered alphabetically by student last name, and include their raw score and % score.

(f) CGSC/ARI-Leavenworth will prepare and submit a written research report of findings.

5. Diagnostic, Post-test and Student Questionnaire Procedures.

a. Purpose. The purpose of this section is to describe the procedures for the administration, and collection of the test instruments required for the RCIIMS evaluation.

b. Diagnostic Test.

(1) A diagnostic test will be administered prior to the initiation of each training session being evaluated. The purpose of the diagnostic test is to conduct statistical measurements of the student population which will be used to control for group equivalency. There is no passing or failing score and the test should not be used as part of the student's training evaluation.

(2) Students should be read the following paragraph prior to the pretest administration: "As part of this course we are investigating various Army wide training techniques. We are not looking at specific students or instructors. The survey which you will be given is part of this study. It will not be used as part of your student evaluation.

c. Post-tests.

(1) Posttests will be administered at the completion of each training session. They will be used as part of the statistical analysis of student performance. The schools may also use these tests as part of the students evaluation, however, the schools must establish their own pass-fail criteria.

(2) Students should be read the following paragraph prior to test administration: "You are now receiving a survey to see how much you learned during this training session. This survey will also be used to give you credit for completing this course."

d. Student Questionnaire.

(1) Student questionnaires will be administered following RCIIMS training sessions. They will be used as part of the overall analysis of program effectiveness. They should not be considered a critique of a specific course or instructor. They will be used to identify trends or areas for further study.

(2) RCIIMS students should be read the following paragraph prior to completing the questionnaire: "Once you have completed the course survey please fill out the student questionnaire. The questions we are asking will help us examine the effectiveness of various Army training programs with different types of classes, such as this one. None of this information will be used as part of your student evaluation. Thank you for your assistance."

6. Administrative Requirements.

a. Ensure the date, location and student information is correctly marked on each sheet.

b. Assign student numbers by ordering tests alphabetically. This can be done after the students are finished.

7. Cost Data Elements. The elements which comprise the true cost of training the student via RCIIMS, resident, or correspondence courses are issues about which serious professionals may honestly differ. The most authoritative source for training costs is the Military Occupational Specialty Training Cost handbook (MOSB) published by the Cost Analysis Division of the U. S. Army Finance and Accounting Center and approved by the Comptroller of the Army.

a. The document cited above references the cost of training a CGSC officer as $______ of which $_____ constitutes the variable cost and the remainder being a fixed cost. The variable and fixed costs are then broken out by OMA, MPA, and Procurement costs. Fixed costs are those costs which remain relatively constant even when the number of student in a course varies. Examples of this type of cost are depreciation of equipment, minimum consumption of utilities, pay of minimum grounds staff, etc. It is apparent that per capital fixed costs will rise with an decreasing number of students and fall with an increasing number of students. This inverse proportionality of average costs to students distinguishes fixed cost from variable cost. Variable costs are directly proportional to the number of students; the more students, the higher variable cost. Examples of variable costs are pay of increasing/decreasing number of instructors, expenditures for expandable items, etc. In contrast to per capita fixed costs, per capita variable costs remain about the same when the number of students changes. Equipment replacement cost is assumed to be entirely fixed as far as the number of students is concerned.

b. The variable portion of costs found in the cited document is based primarily on historical cost and manpower trend analysis of data collected where the specific training was given. They represent a combination of current load sensitive incremental costs funded at three (3) levels of administration,--i.e.--installation, instructional facility, and courses. The load sensitive costs are proportionally derived from historical observation of average incremental cost variations. As can be deduced, this process is involved and time intensive.

c. From the discussion above, the following conclusions may be drawn:

(1) The data will probably be difficult to collect.

(2) The cost figures may not be timely.

(3) Cost data work sheet format must be agreeable to OCSA and that agency which will provide the cost data.

d. Cost data work sheet must also be structured to be consistent throughout and thus form the basis of unimpeachable comparisons among the three types of courses. (RCIIMS, resident, and correspondence).

8. <u>Cost Data Collection Work Sheets.</u> In a previous research effort, the Army Training Support Center developed Cost Data Collection Work Sheets to facilitate their data collection.

a. These work sheets cover the primary cost categories of:

(1) Capital Investments.

(2) Operating and Overhead Costs.

(3) Trainer and Production Staff Costs.

(4) Course Development Costs.

(5) Course Delivery Costs.

b. The work sheets are designed so that actual costs per course can be listed. If this data is not maintained, monthly or yearly costs can be used with estimates drawn from the estimated or actual number of courses involved. (See Appendix B1 - Appendix B5) Data from these work sheets should be used to develop a summary sheet for each cost category. (See Appendix B6 - Appendix B10) The cost data from the summary sheets will be used to conduct the training cost comparisons (Appendix B11) and to make the cost comparisons based upon the assumptions for anticipated RCIIMS usage (Appendix B12). Modifications to the cost effectiveness analysis model may have to be made if cost data, in the specified format, is not available. A more detailed description of the Cost Collection Work Sheets follows in paragraph 9 below.

c. Work Sheets and summary sheets must be clearly annotated as to whether the cost data is per course or per monthly/year. For monthly/yearly cost data the number of courses involved should be included. The actual source of the data should also be included (e.g., OMMCS, 1 Oct 84 to 30 Sept 85 or OMMCS Widget Repair Course 1 Oct 85 to 15 Dec 85). A work sheet for annotating this information is attached. Work sheets must reflect whether data is Not Applicable (NA) or Not Available (N-Avail) if cost data is not presented. All dollar figures should be rounded to the nearest 10 to simplify the accounting procedures and analysis process.

d. The Proration Factor (PF) located on the Cost Comparison Sheets (Appendix B11 and B12) is based upon the economic life (amortization rate) of the facilities and equipment used to conduct the training. This data can be captured in one of two ways. The first is that it is automatically programmed into the rental or per course/per year fee and is considered a course operating cost (See Appendix B2, Section A and B). If the capital investment costs are not factored into the operating and overhead costs they must be accounted for by the Proration Factor. This factor is obtained by determining the economic life of the facilities and equipment and spreading the cost across either the number of anticipated years or anticipated courses. This factor is used to assign a certain

percentage of the capitol investment costs to each of the courses being compared.

e. The Cost Data Collection Work sheets are designed as a cost collection tool to determine the direct and indirect costs associated with the cost of various training techniques. This data will ultimately be used to determine a Cost Per Student Hour for each type of training being examined. This cost figure will in turn be used to determine the Cost Efficiency of the training. The Cost Per Student Hour is essentially the expenditures within the major cost categories of Capital Investment, Operation and Overhead, Trainer and Production Staff, Course Development and Course Delivery Costs spread across the number of students trained by the technique over a specified period of time. The cost efficiency is a measure of the Training Efficiency over the Cost Per Student Hour.

f. The cost data should be based upon the 1987 Fiscal Year or most current available information if FY87 data is not available. The number of classes and students trained during the period associated with the listed costs also needs to be annotated.

g. It is anticipated that most of the cost data maintained by the CGSC may not coincide with the cost categories on the work sheets. That is, the data is not broken out similarly (e.g., by contractor or government provided) or the subcategories are lumped together (e.g., facilities, equipment and technical supplies are not differentiated within Capital Investments and Overhead costs covers all miscellaneous expenses). This should not significantly hamper the final analysis because the work sheets are set up to facilitate the examination of direct and indirect costs related to training and are not all inclusive. It is the determination of the local resource manger as to which costs apply to their training programs. It is the subtotals and total cost for the major cost categories, located on the Cost Category Summary Sheets which are important for the final comparison. Listed below is a more detailed narrative description of the Cost Data Collection Work sheets and the types of cost data to be collected on each.

h. CAPITAL INVESTMENTS: This represents the school's current and projected investment in the facilities and equipment to conduct a particular type of training. Estimates may be required for multi-use facilities or if historical data is not available.

(1) <u>Sunk Costs:</u> These are those costs that have already been expended on Facilities, Equipment Technical Supplies and Services directly related to the training technique.

(2) <u>Research and Development:</u> Costs directly related to pilot efforts within the training methodology.

(3) <u>Programmed Investments:</u> These costs are directly related to expansion of the training methodology. This section represents funds currently allocated by the school for future expansion of the training system.

(4) Capital Investment Costs are indirectly factored into the Cost Per Student Hour. This is done in one of two ways. One, the school may routinely assign a portion of the capital investment costs to the overhead or operating costs for a training methodology. This is akin to a proportion of a rental fee calculated to cover the cost of buying and maintaining the facilities and equipment. Secondly, as is done when conducting cost-benefit studies, the Economic Life of a facility or piece of equipment is determined. The cost of the facility or equipment is then theoretically spread across the anticipated years or projected number of uses (e.g., estimated number of classes to be conducted). The costs are then prorated (as a percentage of the total) by year or by usage. The resource manager should annotate how this is accomplished locally. If not currently factored in, estimate the economic life of the current facilities and equipment to prorate the Capital Investment Costs for the year.

i. OPERATING AND OVERHEAD COSTS: This represents those costs, which are generally monthly or yearly, that are associated with the support and management of training functions. If overhead costs are maintained differently, annotate as such.

j. TRAINER AND PRODUCTION STAFF: Cost data on trainers and production staff is generally maintained as either a fixed monthly or yearly cost or as a variable rate per course. If data is maintained per course the total amount expended during the FY should be included. This cost reflects those personnel required to develop and conduct the training. Indicate if training management and administration personnel are a significant additional cost factor.

k. COURSE DEVELOPMENT COSTS: This data is generally also maintained as a fixed monthly or yearly rate or as variable costs per course. Per Course costs should also be totaled for the year. These costs are essentially those products necessary to support the training programs.

l. COURSE DELIVERY COSTS: These costs are directly associated with the delivery of training. In some cases these costs are already incorporated into previous categories (e.g., facility and equipment costs are part of operating and overhead expenses) or not applicable (e.g., there are no government facilities used or travel conducted by students taking ACCP). Yearly costs or per course totals should be reflected.

Pre Test

Name: ____________________

FOR FACULTY USE ONLY UNTIL PRESENTATION

U.S. ARMY COMMAND AND GENERAL STAFF COLLEGE

ACADEMIC YEAR 1988-89

INSTRUCTIONS

1. Ensure that you enter the last four digits of your social security number and name in the spaces provided on the mark sense form. Record all answers on the mark sense form. DO NOT MAKE MARKS OF ANY KIND ON THE TEST BOOKLET.

2. Check your examination booklet for any missing or defective pages. If you find any, contact the examination administrator.

3. Use only a No. 2 pencil to record your answers. Be sure to completely blacken in the oval corresponding to your selection of the correct answer. If you decide to change an answer, simply erase that mark and blacken another oval.

4. You have one hour to complete the examination.

FOR FACULTY USE ONLY UNTIL PRESENTATION

1. Which of the following will help counter the effects of EMP (electromagnetic pulse) against communication equipment?

1. Hardening the equipment during its design phase.

2. Storing the equipment in a tight closed metal container when not in use.

3. Remoting the antenna as far away from the equipment as possible.

4. Installing and operating the equipment in the prescribed manner. (Select ONE of the following combinations).

A. 1, 2, and 3.

B. 2, 3, and 4.

C. 1, 2, and 4.

D. 1, 3, and 4.

2. The air burst of a nuclear weapon can be described by which of the following characteristic(s)? (Select ONE.)

A. The preferred military "height and burst" mode of targeting.

B. Strong and intense groundshock.

C. Reduction in blast and thermal radiation compared with the effects of a surface burst.

D. Heavy production of fallout.

3. The nuclear weapon effect which is primarily responsible for the destruction of wheeled vehicles is-- (Select ONE.)

A. Initial nuclear radiation.

B. Blast.

C. Residual radiation.

D. EMP.

4. A brigade within a heavy division has which of the following unit(s) permanently assigned? (Select ONE.)

A. Three combat battalions, a headquarters and headquarters company, and a field artillery battery.

B. A headquarters and service company, two mechanized infantry battalions, and one tank battalion.

C. A headquarters and headquarters company.

D. Five battalions, mixed between tank and mechanized, depending on the factors of METT-T.

5. The Army high-to-medium-altitude air defense (HIMAD) weapon systems are-- (Select ONE.)

A. Hawk and PIVADS.

B. PIVADS, Chaparral, and Stinger.

C. Hawk and Stinger.

D. Patriot and Hawk.

6. The corps has a-- (Select ONE.)

A. Fixed structure based on contingency area.

B. Fixed structure based on mission(s).

C. Varying structure based on mission(s).

D. Varying structure based on threat.

7. Who represents the commander at the headquarters of another unit for coordination and for promoting cooperation between the two units?

A. Liaison officer.

B. Chief of staff.

C. Operations officer.

D. Deputy commander.

8. Information that, if known by the enemy, will compromise an operation is called--

A. Essential elements of friendly information.

B. Essential enemy information.

C. Compartmented information.

D. Friendly susceptibilities.

9. What is the principal difference between an operation plan and an operation order?

A. The operation order contains more detailed information than the plan and has the commander's approval.

B. The operation plan contains a notional task organization without specific unit designations and has restricted distribution.

C. The operation order contains assumptions and has an effective date-time group for commencing operations.

D. The operation plan contains assumptions and has no exact starting DTG specified.

10. The five general types of combat orders are--

A. The operation order, logistic order, fragmentary order, oral order, and warning order.

B. The letter of instruction, SOP, directive, administrative/logistic order, and operation plan.

C. The operation order, warning order, fragmentary order, administrative/logistic order, and SOP.

D. The warning order, oral order, administrative order, logistic order, and operation order.

11. The Soviet <u>front</u> is one echelon higher than a(n)-- (Select ONE.)

A. Theater of Military Operations (TVD).

B. Army Group.

C. Division.

D. Army.

12. The 2S3 is a(n)-- (Select ONE.)

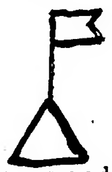
A. Artillery weapon found in the motorized rifle regiment.

B. Heavy mortar found in the high powered artillery brigade.

C. SP artillery weapon found in the artillery regiment, MRD.

D. Armored troop carrier.

13. What does the following Soviet military symbol signify? (Select ONE.)



A. Battalion command observation post.

B. Regiment command observation post.

C. Division command observation post.

D. Army command observation post.

14. The thrust of the maintenance system in the forward area is to repair damaged weapon systems and other equipment as far forward as possible to maximize ________________ and thereby reduce or eliminate ______________.
(Select ONE.)

A. Repair parts availability, maintenance backlog.

B. Combat time, recovery and evacuation time.

C. Efficiency, deadline time.

D. Field services, cannibalization.

15. In a typical J-series armored or mechanized division, the heavy maintenance company of the main support battalion (MSB) provides backup intermediate direct support (IDS) to: (Select ONE.)

A. Aviation maintenance company.

B. Missile support company, MSB.

C. Light maintenance company, MSB.

D. Maintenance company, FSB.

16. Which of the following units are organic to the light infantry division? (Select ONE.)

A. Six light infantry battalions, two antiarmor battalions, and two motorized battalions.

B. Five light infantry battalions, three motorized battalions, and two antiarmor battalions.

C. Nine light infantry battalions.

D. One brigade of light infantry, one brigade of motorized infantry, and one antiarmor brigade.

17. Since there will usually be more critical assets than air defense resources, the assets should be ranked. To develop a priority list, each asset should be assessed from the standpoint of-- (Select ONE.)

A. Vulnerability, criticality, recuperability, enemy air threat, and size.

B. Vulnerability, criticality, recuperability, enemy air threat.

C. Distance from the FEBA, criticality, recuperability, enemy air threat, and size.

D. Distance from the FEBA, criticality, relocation, and enemy air threat.

18. The attack helicopter units of the corps aviation brigade-- (Select ONE.)

A. Are inappropriate for performing deep operations.

B. Mainly fight as battalions.

C. Are not affected by the weather.

D. Can dominate and hold terrain.

19. The command and control headquarters of an infantry division can control up to ____________ maneuver battalions. (Select ONE.)

A. 9.

B. 11.

C. 13.

D. 15.

20. The area air defense commander has disseminated the current air defense weapons control status as WEAPONS TIGHT. The division commander can authorize which of the following without specific approval of the area air defense commander? (Select ONE.)

A. He can authorize WEAPONS FREE.

B. He can authorize WEAPONS HOLD.

C. He is authorized to change the weapons control status to any status without the approval of the area air defense commander.

D. He can authorize his organic air defense weapons to be exempt from the disseminated status.

21. The commander's decision statement provides the necessary elements of--

A. Paragraph 2, Mission, of the OPORD.

B. Paragraph 3a, Concept of the Operation, of the OPORD.

C. Paragraph 1d, Assumptions, of the OPORD.

D. Paragraph 3, Execution, of subordinate unit orders.

22. Where is the commander located during combat operations?

A. Tactical CP.

B. Where he can best command and control.

C. Main CP.

D. With the unit making the main effort.

23. Which deception task is termed a trick of war?

A. Feint.

B. Demonstration.

C. Ruse.

D. Display.

24. Which staff officer reports on matters about the performance of the mission, state of discipline, efficiency and economy of the command?

A. Staff judge advocate.

B. Inspector general.

C. Provost marshal.

D. Command sergeant major.

25. Which command post is responsible for conducting close operations.

A. Forward CP.

B. Rear CP.

C. Main CP.

D. Tactical CP.

26. The Soviet tank division has ____________ tank regiments and ____________ motorized rifle regiment(s). (Select ONE.)

A. Two; one BMP-equipped.

B. Three; one BTR-equipped.

C. Two; two BTR-equipped.

D. Three; one BMP-equipped.

27. The Soviet motorized rifle regiment of the motorized rifle division has ____________ motorized rifle battalion(s) and ____________ tank battalion(s). (Select ONE.)

A. Three; one.

B. Three; no.

C. Two; one.

D. Two; two.

28. A typical Soviet combined arms army (CAA) has ____________ motorized rifle divisions and ____________ tank divisions. (Select ONE.)

A. 3 to 5; 4 to 6.

B. 2; 2 to 4.

C. 4 to 6; 3 to 5.

D. 2 to 4; 1 to 2.

29. The Soviet airborne division has--

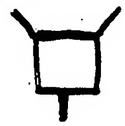
A. Three BMD-equipped airborne regiments.

B. Two BMD-equipped regiments and a parachute regiment.

C. Four BMD-equipped airborne regiments.

D. Two BMD-equipped airborne regiments and two parachute regiments.

30. This symbol represents a-- (Select ONE.)



A. Mortar (up to 120-mm inclusive).

B. Multiple rocket launcher.

C. Battalion command observation post.

D. Medical aid station.

31. A Soviet battalion in an advance guard role normally deploys in the following order-- (Select ONE.)

A. Forward detachment, movement support detachment, main body.

B. Combat reconnaissance patrol, forward security element, main body.

C. Combat reconnaissance patrol, fire support element, main body.

D. Forward security element, main body, rear guard.

32. A typical Soviet motorized rifle division has ________________ motorized rifle regiment and ________________ tank regiment(s). (Select ONE.)

A. Three BTR-equipped and one BMP-equipped; no.

B. Three BMP-equipped and one BTR-equipped; no.

C. Two BTR-equipped and one BMP-equipped; one.

D. Two BMP-equipped and one BTR-equipped; one.

33. The Soviet tank battalion, tank regiment has ________________ tanks while the Soviet tank battalion, motorized rifle regiment has ____________ tanks. (Select ONE.)

A. 31, 40.

B. 40, 31.

C. 42, 35.

D. 52, 42.

34. The Soviet airborne division has--

A. Four BMD-equipped airborne regiments.

B. Two BMD-equipped regiments and a parachute regiment.

C. Three BMD-equipped airborne regiments.

D. Two BMD-equipped airborne regiments and two parachute regiments.

35. The SA-4 is-- (Select ONE.)

A. An SP artillery weapon found in the artillery regiment, MRD.

B. A SAM found in the MRR.

C. Found in the SAM brigade, CAA.

D. Being replaced by the SA-8.

36. The T-12 is a(n)-- (Select ONE.)

A. Main battle tank.

B. Antitank guided missile.

C. 100-mm antitank gun.

D. Armored troop carrier.

37. The SS-23 is found in the-- (Select ONE.)

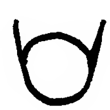
A. Artillery regiment, MRD or TD.

B. SSM battalion, MRD or TD.

C. MRL brigade, front-level artillery division.

D. SSM brigade, army and front-level.

38. This symbol represents a(n)-- (Select ONE.)



A. Antitank mine.

B. Antipersonnel mine.

C. Multiple rocket launcher.

D. Mortar (up to 120-mm inclusive).

39. In a Soviet-style defense, the ______________________________ begins immediately behind the security zone and is 15 to 20 kilometers deep. (Select ONE.)

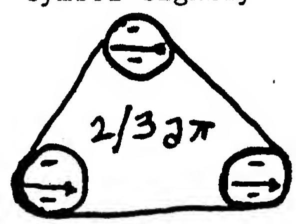
A. First defensive position.

B. Forward edge of the battle area.

C. Main defensive belt.

D. Division defensive zone.

40. What does the following Soviet military symbol signify? (Select ONE.)



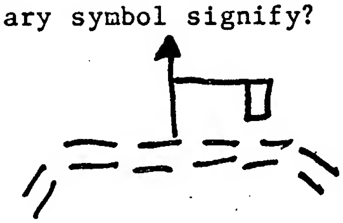
A. Mortar battery in position.

B. Gun artillery battalion in position.

C. Howitzer battalion in an assembly area.

D. Howitzer battalion in position.

41. What does the following Soviet military symbol signify? (Select ONE.)



A. Regimental subsequent objective.

B. Division immediate objective.

C. Regimental immediate objective.

D. Division subsequent objective.

42. The three types of offensive operations used by the Soviet ground forces are-- (Select ONE.)

A. Movement to contact, attack of a defending enemy, and exploitation.

B. Meeting engagement, hasty attack, and pursuit.

C. Meeting engagement, attack of a defending enemy, and pursuit.

D. Movement to contact, deliberate attack, and pursuit.

43. The width of a Soviet regimental zone of advance (offense) will normally vary from-- (Select ONE.)

A. 2 to 3 kilometers.

B. 3 to 8 kilometers.

C. 10 to 15 kilometers.

D. 15 to 25 kilometers.

44. When the Soviet advance guard comes into contact with the enemy to its front, the sequence of units engaged is normally-- (Select ONE.)

A. Forward security element (FSE); combat reconnaissance patrol (CRP); advance guard; main body.

B. CRP, FSE; Advance guard; main body.

C. Advance guard; CRP; FSE; main body.

D. Advance guard; FSE; CRP; main body.

45. When a Soviet division defends on a normal frontage it usually deploys-- (Select ONE.)

A. Two MRRs forward in two defensive positions, one MRR to the rear in a third defensive position, and the tank regiment as a counterattack force.

B. One MRR forward in the first defensive position, a second MRR in the second defensive position, and the tank regiment as a counterattack force in the third defensive position.

C. Two MRRs forward in two defensive positions and the tank regiment in the third defensive position.

D. Three MRRs forward in the first defensive position and the tank regiment in the second defensive position.

46. There are no organic combat service support (CSS) organizations assigned at brigade level in divisions. Each brigade relies on higher combat service support from: (Select ONE.)

A. DISCOM and some units from the COSCOM.

B. COSCOM area support groups medical.

C. COSCOM and some elements from TAACOM.

D. DS and GS organizations specifically tailored on a mission, area, or task basis.

47. Identify the five organizations in a typical COSCOM. (Select ONE.)

A. Medical, construction, ammunition, personnel, and support groups.

B. COMSEC, transportation, ammunition, personnel, and support groups.

C. Medical, transportation, ammunition, topographic, and support groups.

D. Medical, transportation, ammunition, personnel, and support groups.

48. To sustain tactical operations for a specified period, unit S3s/G3s indicate their class V needs by preparing a ______________________, which is consolidated and passed higher through S3/G3 channels. (Select ONE.)

A. Controlled supply rate (CSR).

B. Requisition for ammunition resupply.

C. Required supply rate (RSR).

D. Basic load table (BLT).

49. The evacuation policy for the combat zone is established by the theater commander and designates: (Select ONE.)

A. The priority evacuation mode to be air or ground transportation.

B. The maximum period of hospitalization that patients may be held within the combat zone for treatment.

C. The period of time that patients will be retained for treatment in corps hospitals to prevent overloading of hospitals in the combat zone.

D. The period of time required for treatment before patients can be returned for duty to their units.

50. The authorized nonnuclear ammunition that must be on hand in a unit at all times is the-- (Select ONE.)

A. Authorized stockage list (ASL).

B. Prescribed load list (PLL).

C. Controlled supply rate (CSR).

D. Available supply rate (ASR).

E. Basic load (BL).

FOR TURN-IN

U.S. ARMY COMMAND AND GENERAL STAFF COLLEGE

M318A/8
(Version A)

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COMMAND AND GENERAL STAFF OFFICER COURSE--NONRESIDENT

EXAMINATION

M318A/8 (Version A)

COMBAT OPERATIONS

LESSON 1. COMBAT FUNDAMENTALS

Section I. Examination Booklet

INSTRUCTIONS

1. You have been issued an examination booklet consisting of 35 pages and 1 answer sheet. Check now to see that you have this material and that none is defective.

2. This examination consists of 66 multiple-choice items.

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3. During this examination, only questions resulting from faulty printing will be answered by the instructor.

4. The reproduction of any portion of this examination is prohibited.

5. Students will not disclose information pertaining to the examination items, answers, or the solution-discussion conducted as a part of this examination period.

6. You will have 90 minutes to complete the examination.

7. Items 47 through 66 are open book (ST 63-1 and ST 101-2 only).

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Indicate your answers on the answer sheet.

NOTES: 1. Items do not pertain to any general or special situation.

2. Items 1 through 46 pertain to instructional material from the Center for Army Tactics (CTAC) and the US Air Force; items 47 through 66 pertain to instructional material from the Department of Sustainment and Resourcing Operations (DSRO). You must pass both the CTAC and the DSRO portion of this examination. If you fail to pass either portion, that portion of the examination must be retaken before you receive a passing grade for lesson 1.

1. The most essential element among the dynamics of combat power is--(Select ONE.)

A. Firepower.

B. Maneuver.

C. Leadership.

D. Protection.

AirLand Battle Doctrine is based on gaining or retaining the initiative and aggressively accomplishing the mission. Success in battle will depend on the Army's ability to fight in consonance with four basic tenets. Items 2 through 4 relate to the tenets of AirLand Battle.

2. The tenet of ________ requires that leaders read the battlefield, decide quickly, and be capable of shifting the main effort with minimal coordination and delay. (Select ONE.)

A. Agility.

B. Initiative.

C. Depth.

D. Synchronization.

E. Deception.

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3. Momentum in the attack and elasticity in the defense are tied to the tenet of ________. (Select ONE.)

A. Agility.

B. Initiative.

C. Depth.

D. Synchronization.

E. Deception.

4. The end result of effective ________ is maximum economy of force, with every resource used where and when it will make the greatest contribution to success. (Select ONE.)

A. Agility.

B. Initiative.

C. Depth.

D. Synchronization.

E. Deception.

5. What is the primary purpose of sound tactics? (Select ONE.)

A. To secure policy objectives by the application or threat of force.

B. To employ military forces to attain strategic goals in a theater of operations.

C. To win the battles and engagements that produce successful campaigns.

D. To standardize warfighting procedures and improve interoperability.

6. Corps and divisions must plan to conduct mutually supporting operations simultaneously in three areas. Those three areas are-- (Select ONE.)

A. Strategic, operational, and tactical.

B. Close, deep, and rear operations.

C. Tactical, main, and rear.

D. Current, future, and contingency operations.

7. Which of the following statements are true regarding battlefield air interdiction (BAI).

(1) The objective is to delay, disrupt or destroy follow-on forces.

(2) Missions can be flown as an immediate air strike.

(3) BAI may have a direct or near-term effect on ground operations.

(4) Missions are typically flown in the vicinity of the fire support coordination line (FSCL).

(Select ONE.)

A. (1) and (2).

B. (1), (2), and (4).

C. (1), (3), and (4).

D. (2) and (4).

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8. Air superiority is the most critical mission of tactical fighter forces. Which of the following missions support air superiority?

(1) Air interdiction (AI).

(2) Offensive counterair (OCA).

(3) Defensive counterair (DCA).

(4) Suppression of enemy air defenses (SEAD).

(5) Battlefield air interdiction (BAI).

(Select ONE.)

A. (1), (2), and (3).

B. (1), (2), (3), and (5).

C. (2), (3), and (4).

D. (1), (3), (4), and (5).

E. (2), (4), and (5).

9. Regarding the apportionment decision, which statement is correct? (Select ONE.)

A. The apportionment decision depends on the mission and enemy threat.

B. The Land Component Commander is limited to 50 percent of the available airpower.

C. Counterair is always given a higher percentage than close air support.

D. Apportionment is the responsibility of the Air Component Commander.

10. The current tactical airlift capabilities of the C-130 are--

(1) Landing on austere airfields.

(2) Delivering troops or cargo.

(3) Transporting outsized cargo.

(4) Performing airdrop or airland operations.

(Select ONE.)

A. (1), (2), and (4).

B. (2), (3), and (4).

C. (1) and (3).

D. (1), (2), (3), and (4).

11. The tactical airlift request system differs from the regular air request system in that immediate airlift requests are routed-- (Select ONE.)

A. To the COSCOM commander.

B. Through Air Force channels.

C. To the corps TALO.

D. Through Army channels.

12. The Air Component Commander (ACC) exercises centralized control of his air assets through the-- (Select ONE.)

A. Combat control team (CCT).

B. Forward air control post (FACP).

C. Tactical air control center (TACC).

D. Tactical air control party (TACP).

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13. Select the principal functions performed by the contingency Tactical Air Control System (TACS).

(1) Management of tactical air support.

(2) Airspace surveillance and control.

(3) Management of tactical airlift.

(4) Subapportionment of allocations.

(Select ONE.)

A. (1), (2), (3), and (4).

B. (1), (2), and (3).

C. (1), (3), and (4).

D. (2), (3), and (4).

14. The allocation of sorties is the responsibility of-- (Select ONE.)

A. The Air Component Commander (ACC).

B. The Land Component Commander (LCC).

C. The Joint Force Commander (JFC).

D. The battlefield coordination element (BCE).

15. Airspace control reduces interference between airspace users, enhances the flexibility of weapon systems, and ensures efficient employment of air defense assets. The most commonly used procedural control means are--

(1) High-density airspace control zone (HIDACZ).

(2) Restricted operations area (ROA).

(3) Fire support coordination line (FSCL).

(4) Battle handover line (BHOL).

(5) Minimum risk routes (MRR).

(Select ONE.)

A. (1), (2), (3), and (4).

B. (1), (2), and (5).

C. (2), (4), and (5).

D. (1), (2), and (4).

E. (1), (3), (4), and (5).

16. Tactical air reconnaissance preplanned requests are to be submitted ____________ hours in advance. (Select ONE.)

A. At least 24.

B. At least 3.

C. At least 6.

D. At least 15.

17. The purpose of the intelligence preparation of the battlefield (IPB) is to-- (Select ONE.)

A. Determine mobility corridors and avenues of approach.

B. Provide terrain analysis and the influence of weather on the avenues of approach.

C. Predict the enemy course of action and tell the commander where he should fight the enemy.

D. Provide an analysis of the battlefield area and probable enemy courses of action and intentions.

18. IPB is a process that-- (Select one OR MORE.)

A. Is continuous, systematic, and the staff responsibility of the G2.

B. Is cyclical and accomplished through the development of templates.

C. Dictates to the commander the decisions that are significant.

D. Analyzes enemy capabilities throughout the area of influence.

19. Terrain is analyzed at all staff levels during the IPB process. The G2 evaluates the battlefield area for enemy, weather, and terrain. The battlefield area includes which of the following?

(1) Area of influence.

(2) Area of operations.

(3) Area of mobility.

(4) Area of interest.

(Select ONE.)

A. (1), (2), and (3).

B. (1) and (2).

C. (2) and (4).

D. (1), (3), and (4).

20. When developing a situation template, the G2/G3 must consider--(Select ONE.)

A. Doctrinal templates, event templates, and areas of interest.

B. Doctrinal templates, terrain and weather, and confirmed intelligence.

C. Where critical events and specific activities are expected to occur and where critical targets will appear.

D. Significant factors and feasible courses of action relative to battlefield events.

21. Threat integration is a sequential process. The objective of threat integration is to determine how the enemy will fight. The final product of the integration is-- (Select ONE.)

A. Event template.

B. Decision support template.

C. Doctrinal template.

D. Situation template.

E. Operational template.

22. The principal templates used in the IPB process to identify and assess enemy capabilities are-- (Select ONE.)

A. Doctrinal, sequential, event, and decision support.

B. Doctrinal, situation, weather and terrain, and operational.

C. Doctrinal, situation, event, and decision support.

D. Mobility, situation, event, and decision support.

23. Of the choices listed, which describes the defensive pattern that destroys the attacking force by permitting the enemy to advance into a position that exposes him to counterattack and subsequent envelopment? (Select ONE.)

A. Area defense.

B. Mobile defense.

C. Forward defense.

D. Flexible defense.

E. Tripwire defense.

24. Which of the following choices is a form of defense focusing on the retention of terrain by absorbing an enemy into an interlocking series of positions and destroying him primarily by fire? (Select ONE.)

A. Area defense.

B. Mobile defense.

C. Forward defense.

D. Flexible defense.

E. Tripwire defense.

25. One of the key elements of the offensive and defensive battlefield framework is operations in the main battle area (MBA). Which of the following is also an element (are also elements) of the offensive and defensive framework? (Select one OR MORE.)

A. Reserve operations.

B. Security force operations.

C. Future operations.

D. Deep operations.

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26. Which of the following are purposes of the offense?

(1) Secure key or decisive terrain.

(2) Preserve combat strength.

(3) Gain information.

(4) Disrupt an enemy attack.

(5) Retain tactical objectives.

(Select ONE.)

A. (1), (2), and (4).

B. (2), (3), (4), and (5).

C. (1), (2), (4), and (5).

D. (1), (3), and (4).

27. Which of the following are purposes of defensive operations?

(1) Gain information.

(2) Defeat an enemy attack.

(3) Control key or decisive terrain.

(4) Concentrate forces elsewhere.

(5) Gain time.

(Select ONE.)

A. (1), (2), (3), and (4).

B. (1), (2), (3), and (5).

C. (1), (2), (4), and (5).

D. (1), (3), (4), and (5).

E. (2), (3), (4), and (5).

28. Which of the following are the fundamental characteristics of defensive operations? (Select ONE.)

A. Preparation, disruption, concentration, and flexibility.

B. Preparation, attack, exploitation, and pursuit.

C. Penetration, envelopment, turning movement, and infiltration.

D. Surprise, concentration, speed, flexibility, and audacity.

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29. Which of the following are the phases of offensive operations? (Select ONE.)

A. Deep, security, main battle area, reserve, and rear.

B. Preparation, attack, exploitation, and pursuit.

C. Surprise, concentration, speed, flexibility, and audacity.

D. Planning, preparation, execution, and consolidation.

30. Which of the following is generally the least economical form of offensive maneuver since it exposes the attacker to the concentrated direct fires of the defender? (Select ONE.)

A. Penetration.

B. Envelopment.

C. Turning movement.

D. Infiltration.

E. Frontal attack.

31. The primary functions of a corps or division main command post (CP) are--

(1) Conduct close-in operations.

(2) Synchronize the battle.

(3) Conduct deep operations.

(4) Plan future operations.

(Select ONE.)

A. (1), (2), (3), and (4).

B. (1) and (2).

C. (1), (3), and (4).

D. (2), (3), and (4).

32. When planning command post operations, an acceptable balance must be achieved between two major categories. These two categories are-- (Select ONE.)

A. Survivability and deception.

B. Size and location.

C. Survivability and effectiveness.

D. Automation and hardening.

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33. The staff analyses, which build the command estimate, result in which of the following?

(1) Identification of courses of action that are not feasible.

(2) A decision on how to accomplish a particular mission.

(3) Conclusions and recommendations that identify the best course of action.

(Select ONE.)

A. (1), (2), and (3).

B. (1) and (2).

C. (3) only.

D. (2) and (3).

E. (1) and (3).

34. Complete this sentence: "The command estimate ________."

(1) Highlights the information the commander needs to make timely, accurate decisions.

(2) Relies on formal (written) staff estimates as the means of evaluating all information received by the command.

(3) Provides a means for principal staff officers to quickly and logically assess information and provide sound recommendations to the commander.

(4) To be useful, requires staff officers who are tactically proficient.

(Select ONE.)

A. (1), (2), (3), and (4).

B. (1), (2), and (3).

C. (1), (2), and (4).

D. (1), (3), and (4).

E. (2), (3), and (4).

35. IAW ST 100-9, the stated mission becomes ________ of the operation plan or operation order. (Select ONE.)

A. Paragraph 1a.

B. Paragraph 3a.

C. Paragraph 2.

D. Paragraph 4.

E. Paragraph 1b.

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36. IAW ST 100-9, the result of the commander's mission analysis is-- (Select ONE.)

A. The concept of the operation.

B. The stated mission.

C. The commander's intent.

D. The commander's estimate of the situation.

37. Mission is defined as a statement of the job to be performed by a unit. The mission statement pertaining to an operation contains which of the following elements? (Select one OR MORE.)

A. Who.

B. What.

C. When.

D. Where.

E. How.

F. Why.

38. Mission analysis identifies the--

(1) Area of operations.

(2) Intent of the commanders one and two levels up.

(3) Tasks to be performed.

(4) Command and control requirements.

(5) Constraints and restraints.

(6) Assets available.

(Select ONE.)

A. (1), (2), (3), (4), and (5).

B. (1), (2), (3), (4), and (6).

C. (1), (2), (4), (5), and (6).

D. (1), (2), (3), (5), and (6).

E. (2), (3), (4), (5), and (6).

39. Implied tasks are identified during mission analysis. They are-- (Select ONE.)

A. Located in paragraph 3b(1) of the higher headquarters plan or order.

B. Depicted on the operation overlay of the higher headquarters plan or order.

C. Found through further analysis of the higher headquarters plan or order by reading between the lines.

D. Listed in the higher headquarters plan or order in paragraph 1d, Assumptions.

40. Which of the following statements is (are) true concerning the identification of essential tasks during the mission analysis process? (Select one OR MORE.)

A. Essential tasks are determined from specified tasks and/or implied tasks.

B. Essential tasks are those that must be accomplished to complete the overall mission.

C. Inherent, routine, or SOP items are included in the essential tasks.

D. Essential tasks are found in the stated mission.

41. The ultimate goal of course of action development during the command estimate process is-- (Select ONE.)

A. To refine the mission statement.

B. To revise, reject, or validate the task organizations.

C. To shorten the decisionmaking cycle, thereby providing more time to subordinate units.

D. To develop several feasible courses of action for every enemy course of action developed by the G2.

42. Which of the following statements is true regarding the initial array of friendly ground maneuver forces during a defensive course of action development? (Select ONE.)

A. The array is initiated by placing ground maneuver forces on enemy avenues of approach that enter the unit area.

B. Friendly forces are arrayed one level down at the expected point of initial contact.

C. The friendly force array should depict the type of maneuver unit (e.g., mechanized, armored, etc).

D. The initial array determines the force task organization and subordinate unit missions.

43. During course of action analysis (war gaming), certain techniques are available for organizing the area to be analyzed. From the list below, which are explained as war gaming techniques in ST 100-9?

(1) Avenue-in-depth technique.

(2) Belt technique.

(3) Box technique.

(4) Critical event technique.

(Select ONE.)

A. (1), (2), (3), and (4).

B. (1), (2), and (4).

C. (1), (3), and (4).

D. (1), (2), and (3).

E. (2), (3), and (4).

44. Which of the following are true with respect to course of action analysis (war gaming)?

(1) The G3 is the only staff officer who war games a course of action.

(2) The process is one of action--reaction--counteraction.

(3) The war game is conducted to verify the use of maneuver units only.

(4) Courses of action are compared and rank ordered during the war game.

(5) A course of action may be modified if critical events, requirements, or problems are identified during the war game.

(Select ONE.)

A. (1), (3), and (5).

B. (2) and (4).

C. (1), (2), and (3).

D. (3), (4), and (5).

E. (2) and (5).

45. A war game by the G3 results in which of the following? (Select one OR MORE.)

A. Tasks to subordinate units.

B. Identification of advantages and disadvantages.

C. Validation of the most probable enemy course of action.

D. An estimate of battle duration of each critical event.

E. Refinements or modifications to the course of action.

46. Which of the following responses is (are) correct regarding the comparison of feasible courses of action? (Select one OR MORE.)

A. Each staff officer may use his own matrix for comparison in his own area of responsibility.

B. Numerical values or plus-minus values are assigned to each factor in the comparison, and a mathematical summary of the results determines the course of action selected.

C. If the staff cannot agree on which course of action to recommend, the chief of staff decides on the course of action to recommend to the commander.

D. The comparison may follow any technique that will allow a recommendation to be reached.

SUSTAINMENT QUESTIONS BEGIN HERE

47. Which characteristic(s) of wartime strength accounting systems is (are) correct? (Select one OR MORE.)

A. The most important consideration in strength accounting is speed of reporting.

B. The Personnel Daily Summary (PDS) is transmitted through S1/G1/deputy chief of staff, personnel (DCSPER), channels.

C. The qualitative gross strength data in the Personnel Daily Summary (PDS) is sustainment oriented.

D. The Personnel Daily Summary (PDS) is part of the Personnel Requirement Report (PRR).

48. Which statement(s) is (are) correct in relation to the weapon system replacement operations (WSRO) system? (Select one OR MORE.)

A. The WSRO system is a personnel accounting system based on primary weapon system densities.

B. Personnel operations centers, replacement detachments, and personnel service companies establish personnel replacement priorities.

C. The commander's priorities for the allocation of replacement weapon systems within a division should be based on future missions.

D. The WSRO system is designed to supply the combat commander with replacement, ready-to-fight, major weapon systems.

49. Select the statement(s) that correctly describe(s) medical support in the theater of operations. (Select one OR MORE.)

A. The corps evacuation policy is determined by the theater commander with the recommendations of the corps commanders and the advice of the theater surgeon.

B. The number and types of patients impact on the relative mobility of combat zone hospitals.

C. The primary mission of evacuation hospitals is to determine if further evacuation is necessary.

D. Hospitalization in the combat zone is provided by three types of corps hospitals: combat support, field, and evacuation.

NOTE: Using chart 1, which is a foldout at the back of this examination, and the following information, answer questions 50 through 52. Chart 1 shows typical direct support units (DSUs), general support units (GSUs), management centers, and support bases located in a theater of operations. They are identified by reference letters "A" through "O." Select the sequence of reference letters that correctly describes a requisition process and the subsequent materiel flow from and back to the depicted nondivisional maneuver unit. Assume that throughput is not available unless stated otherwise in the response.

50. An item of class II non-air lines of communication (non-ALOC) is not available at the direct support unit (DSU) but is available within the corps support command (COSCOM). (Select one OR MORE.)

A. A - I - B - A (using throughput).

B. A - I - G - B - A.

C. A - B - I - G - B - A.

D. A - D - I - H - D - A.

51. A class VII item is not command regulated and is not available in your supporting DSU but is available in TA. (Select one OR MORE.)

A. A - D - I - E - O - M - D - A.

B. A - B - I - E - O - M - B - A.

C. A - B - I - E - O - B - A (using throughput).

D. A - B - I - O - M - B - A.

52. An item of class IX (ALOC) is not available in your supporting intermediate direct support unit (IDSU) or the COSCOM general support unit (GSU). (Select one OR MORE.)

A. A - D - I - E - O - H - D - A.

B. A - D - K - I - E - O - H - K - D - A.

C. A - D - I - J - G - D - A.

D. A - D - I - J - D - A.

NOTE: Using chart 1 and the following information, answer items 53 and 54. Select the correct sequence of reference letters that describes the complete maintenance evacuation process of a nonoperational M1 tank, its repair, and its return (or a replacement issue) to the using unit. There are no M1 operational readiness floats available. Assume throughput and automatic evacuation instructions are not available unless stated otherwise in the response.

53. The M1 is reparable at the IDS level but cannot be repaired within 96 hours. (Select one OR MORE.)

A. A - D - O - M - B - A.

B. A - D - I - E - O - M - B - A.

C. A - D - I - E - O - B - A (using throughput).

D. A - D - K - I - E - O - M - B - A.

54. The M1 tank requires IDS maintenance that will take 60 hours. (Select one OR MORE.)

A. A - D - A.

B. A - D - I - K - D - A.

C. A - D - K - I - E - O - M - B - A.

D. A - D - K - D - A (with automatic evacuation instruction).

55. The normal method of class ____________ distribution from the ____________________________ to the ____________________________ is ____________________________. (Select one OR MORE.)

A. III (bulk), general support level, direct support level, unit.

B. V, corps storage area, ammunition transfer point (ATP), supply point.

C. V, ATP, user, supply point.

D. III (bulk), direct support level, user level, supply point.

56. Which of the following correctly describes the class III (bulk) estimating process? (Select one OR MORE.)

A. Class III (bulk) is a scheduled supply.

B. Using units submit forecasts.

C. Petroleum, oils, and lubricants (POL) issuing units submit daily issue reports.

D. Materiel management centers (MMCs) provide distribution instruction to POL supporting units.

57. Which statement(s) is (are) correct in relation to maintenance and class IX? (Select one OR MORE.)

A. Maintenance company, intermediate direct support (IDS) (COSCOM), can provide IDS maintenance to divisional units moving through the rear of the combat zone.

B. Repair parts supply company (general support (GS)), disassembles and disposes of classes VII and IX materiel.

C. Maintenance company, IDS (backup), can provide maintenance support teams well forward in the combat zone to repair weapon systems.

D. Divisional maintenance company, IDS, main support battalion, provides routine IDS maintenance to nondivisional artillery battalions.

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58. Which of the following correctly describes intermediate direct support maintenance (IDSM) units? (Select one OR MORE.)

A. IDSM units provide maintenance support teams to repair items as far forward as possible.

B. IDSM units are responsible for recovery of supported unit equipment from the battlefield.

C. IDSM units repair equipment and return it to the supply system.

D. IDSM units provide operational readiness floats to fill unit supply shortages.

59. Select the correct statement(s) that describe(s) transportation terminal operations. (Select one OR MORE.)

A. A terminal transfer unit accomplishes the transshipment of cargo from rail to aircraft.

B. A terminal service unit offloads cargo from ships.

C. A terminal transfer unit transships cargo from aircraft to rail.

D. A terminal service unit provides long-term storage of supplies.

60. The type of organization that will coordinate a 50-kilometer road movement from the port area (consignor) to the origin rail terminal and then coordinate the destination (consignee) capability to receive and offload the shipment is a ______________________________. (Select one OR MORE.)

A. Materiel management center (MMC).

B. Transportation brigade.

C. Movement control team (MCT).

D. Motor transport group.

61. When it becomes necessary to restore a unit to combat effectiveness, the commander selects a method of reconstitution based on input from the staff and subordinate commanders. Which objective factors should influence the commander's choice of the method of reconstitution to employ? (Select one OR MORE.)

A. Future missions.

B. Time and resources available.

C. Morale and esprit de corps.

D. Current status of the unit.

62. Which statement(s) correctly describe(s) the force reconstitution process? (Select one OR MORE.)

A. There are two basic types of reconstitution: reorganization and regeneration.

B. Regeneration is controlled by the unit to be regenerated.

C. Reconstitution procedures should be included in unit SOPs.

D. Reorganization can take place anywhere from the forward line of own troops (FLOT) to secure areas in the rear.

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Using ST 101-2, June 1987, with change 1, answer questions 63 through 66.

63. Select the statement(s) that is (are) correct in relation to estimated daily personnel losses. (Select one OR MORE.)

A. On the first day of a defense of a sector, a division in contact is estimated to lose 3.5 percent of its strength to battle and nonbattle causes.

B. On the succeeding days of a defense of a position, a division in reserve is estimated to lose 1.9 percent of its strength to battle and nonbattle causes.

C. Given that an armored division is estimating 100 battle losses, the estimated number of wounded is 84.

D. Given that an armored division is estimating 100 battle losses, the estimated number of killed in action (KIA) is 10.

64. Select the statement(s) that is (are) correct in relation to estimated consumption of supplies. (Select one OR MORE.)

A. The weight of class X estimated for a 10,000-soldier force is 12.5 short tons per day.

B. The weight of class VI estimated for a 10,000-soldier force is 16 short tons.

C. Base development in the rear combat zone is estimated to require 4.5 pounds per person per day of class IV.

D. The consumption rate for class VI is 15 pounds per man per week.

65. Select the statement(s) that is (are) correct in relation to class III (bulk). (Select one OR MORE.)

A. A US division operating in Europe is estimated to move its wheeled vehicles 101 km per day.

B. A J-series mechanized division (SRC 87000J440) is estimated to use 13,317 gallons of aviation fuel per hour of organic aviation equipment operation.

C. A US division operating in Europe is estimated to use less fuel for tracked vechicles on secondary roads than the same division would in CONUS.

D. Table 2-15, Class III Bulk Planning Factors, provides different planning factors for the offense and for the defense.

66. Select the statement(s) that is (are) correct in relation to class V. (Select one OR MORE.)

A. The estimated required supply rate (RSR) for the 40-mm M203 on the first day of an attack of a position for a heavy division (SRC 87000J430) is 32 rounds per weapon per day.

B. The controlled supply rate (CSR) and RSR are equal when the logistic system can provide the estimated quantity of ammunition required by the commanders.

C. A heavy division (SRC 87000J430) is estimated to require 2,651.6 short tons of ammunition on the first day of a defense of a position.

D. A heavy division (SRC 87000J430) is estimated to require more ammunition in the defense than in the offense.

M318A/8
(Version A)

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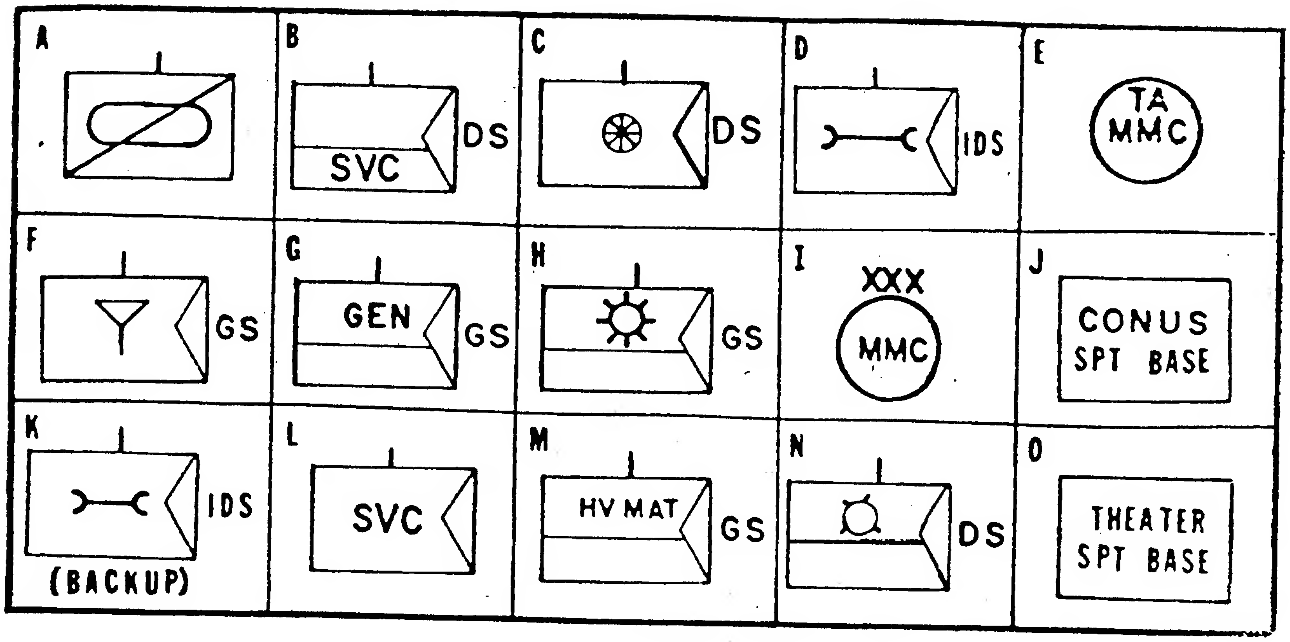
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FOR TURN-IN

U.S. ARMY COMMAND AND GENERAL STAFF COLLEGE

M310A/8
(Version A)

THIS EXAMINATION AND ALL MATERIAL ISSUED WITH IT WILL BE TURNED IN AFTER THE SOLUTION-DISCUSSION PERIOD

COMMAND AND GENERAL STAFF OFFICER COURSE--NONRESIDENT

EXAMINATION

M310A/8 (Version A)

SOVIET ARMY OPERATIONS

Section I. Examination Booklet

INSTRUCTIONS

1. You have been issued the examination consisting of 17 printed pages and an answer sheet. Check now to see that you have this material and that none is defective.

2. This examination consists of 25 multiple-choice items. Each item is worth four points. There is only one answer for each item.

3. During this examination, no questions will be answered by the instructor other than those attributed to faulty printing.

NOT TO BE REPRODUCED
DESTROY AFTER EXAMINATION ADMINISTRATION

4. Students will not disclose information pertaining to the examination items, answers, or the solution-discussion conducted as a part of this examination period.

5. The possession or use of texts, notes, issue materials, and other references is prohibited during the examination except for the use of P033 (COMPS), Soviet Ground Forces, and FM 100-2-3, Soviet Army Troops, Organization and Equipment.

ITEMS

1. If the execution of an offensive operation does not go as planned, what initial action will the Soviet combined arms army commander and his staff take? (ELO B.03)

A. Continue to move forward trying to restore the plan, but make changes as necessary based on the initiative and audacity of the commander and his best estimate of the situation.

B. Continue to move forward trying to restore the plan, but consider possible alterations based on variants that were examined during the decisionmaking process.

C. Continue to move forward trying to get back on plan, and call the front commander and request another two to three divisions.

D. Halt, move into a hasty defense, and rework the plan based on the new correlation of forces as they exist at this time.

2. Which of the following statements best describes the main command post in a Soviet division? (ELO B.04)

A. It is the primary location of the commander and his immediate working staff, such as the operations officer and the intelligence officer.

B. It is the primary command post that monitors the battle and plans for future operations and is generally located in the area of the main effort.

C. It is located well forward and allows the commander and his artillery support to observe the battle firsthand and control the fires of artillery and other means of fire support.

D. It is the primary CP within the division but, due to its vulnerabilities, is located behind the second echelon and maintains a relativelv low profile in order to ensure survivability.

M310A/8
(Version A)

3. What principles of military art best represent Soviet offensive operations? (ELOs A.01, A.02)

A. Surprise, mobility, and high tempo.

B. Simultaneous action and simplicity.

C. Combat activeness, security, and unity of command.

D. Conformity of the goal and plan to the conditions of battle and coordination.

4. The Soviet military decisionmaking process can best be characterized as a process that uses mathematical models, algorithms, and nomograms;--(ELO B.03)

A. Involves close interaction between the staff and commander at all echelons; and allows decisions to be made based on the initiative of the lower level commanders.

B. Is highly rigid; and requires that decisions be made at the highest level possible.

C. Is loosely structured; and leaves much of the decisionmaking to the staff while the commander observes, critiques, and gives guidance as necessary prior to final approval of the decision.

D. Relies on mission-type orders from the highest echelon; and allows for detailed planning to be conducted at division and below.

5. How would you best characterize the Soviet concept of echelonment? (ELO B.01)

A. The first echelon will consist of motorized rifle forces and the second echelon will consist of tank forces.

B. The first echelon will consist of tank forces and the second echelon, of motorized rifle forces.

C. There is no fixed concept, and the echelonment of forces will be determined by the structure of the defensive force being faced.

D. The first echelon will consist of one-half of the total force available to the commander.

6. Which of the following forces would most likely be used to conduct offensive combat operations at a depth of 30 to 100 kilometers in front of the attacking Soviet forces? (TLO D)

A. Mobile obstacle detachment.

B. An air assault brigade.

C. Spetsnaz forces from the combined arms army.

D. Long-range reconnaissance forces.

M310A/8
(Version A)

7. From the following list, select the primary targets of spetsnaz units. (TLO D)

(1) Nuclear delivery means or storage sites.

(2) Tank battalion forward positions.

(3) The protection of Kremlin leaders.

(4) Key political and military leaders.

A. (1) and (4).

B. (1) and (3).

C. (2) and (4).

D. (3) and (4).

8. Considering the Soviet experience in World War II, which statement below shows the best relationship between the principles of operational art and tactics and the organization of the Soviet ground forces? (ELO A.02)

A. Strategic defenses must be fully prepared in order to preclude the success of enemy surprise attacks.

B. "Pure" units making battalion- and regimental-sized attacks will be most successful on the future battlefield.

C. Offensive operations into the depths of the enemy defenses are the most productive.

D. Defensive operations with selective deep strikes by offensive forces will be the most effective way of waging war in the near future.

9. What do Soviet staffs consider in the automated troop control system? (ELO B.02)

A. The correlation of forces based on the quantity of units on the battlefield.

B. The enemy, weather, and terrain only.

C. The correlation of forces based on the quantity of systems on the battlefield and the qualitative factors for each of those systems.

D. The requirement for a minimum force correlation of 3:1 across the entire zone of attack.

10. Which principle best describes the Soviet logistic support system? (ELO C.01)

(1) Use of all possible resources.

(2) Delivery forward.

(3) Forward positioning of support elements.

(4) Complete mobile support.

A. (1), (3), and (4).

B. (1) and (3).

C. (1), (2), (3), and (4).

D. (2) and (4).

M310A/8
(Version A)

11. Within the supply system, the order of priorities for equipment and supplies for an offensive operation appears to be-- (ELO C.01)

A. Nuclear- or chemical-capable missiles, conventional ammunition, POL, technical parts, food.

B. Technical parts, conventional ammunition, POL, food, nuclear- or chemical-capable missiles.

C. POL, technical parts, food, nuclear- or chemical-capable missiles, conventional ammunition.

D. Food, technical parts, POL, conventional ammunition, nuclear- or chemical-capable missiles.

12. "Fire in support of the attack" (phase III) is best described as artillery and rocket fire rendered to maneuver forces that is intended-- (ELO C.03)

A. To destroy or suppress enemy troops and weapon systems forward of friendly attacking troops and to prevent the enemy from restoring fire, command and control, and observation systems that were earlier disrupted.

B. To protect the force as it moves from its assembly area to the line of departure.

C. To destroy and suppress enemy weapon systems, command and control elements, and troops in the tactical and immediate operational depth of the threat defenses.

D. To provide on-call fires as a maneuver force attacks enemy defenses from the march.

13. The Soviet concept of fire support can be described as a process whereby-- (ELO C.03)

A. Commanders allocate artillery to subordinate units and then allow these unit commanders the flexibility to use that artillery as they deem necessary.

B. The TOE organization allows for artillery support at all echelons, thereby providing each commander the assets necessary to accomplish most missions and alleviating the requirement to task organize artillery.

C. The assets are allocated and the fire plans and ammunition are directed from the highest levels, thereby augmenting organic assets.

D. Allocation and fire planning are highly centralized but execution is decentralized, allowing for individual flexibility and initiative in the call-for-fire process.

14. Artillery norms-- (ELO C.03)

A. Are guides for the offense and rigidly followed in the defense.

B. Assist chiefs of rocket troops and artillery (CRTAs) in determining the proper amounts of ammunition to requisition in the offense and defense.

C. Are best guesses by the Soviet general staff to destroy NATO defenses quickly.

D. Are constrained due to transportation availability.

M310A/8
(Version A)

SPECIAL SITUATION

NOTE: Special situation and sketch map A pertain to item 15.

15. You are the division G2. Sketch map A portrays the information you have pieced together about the threat attack. You are about to brief the CG and the G3. Your best estimate of the situation is that your unit is being attacked by a combined arms army that is arrayed with-- (ELO E.01)

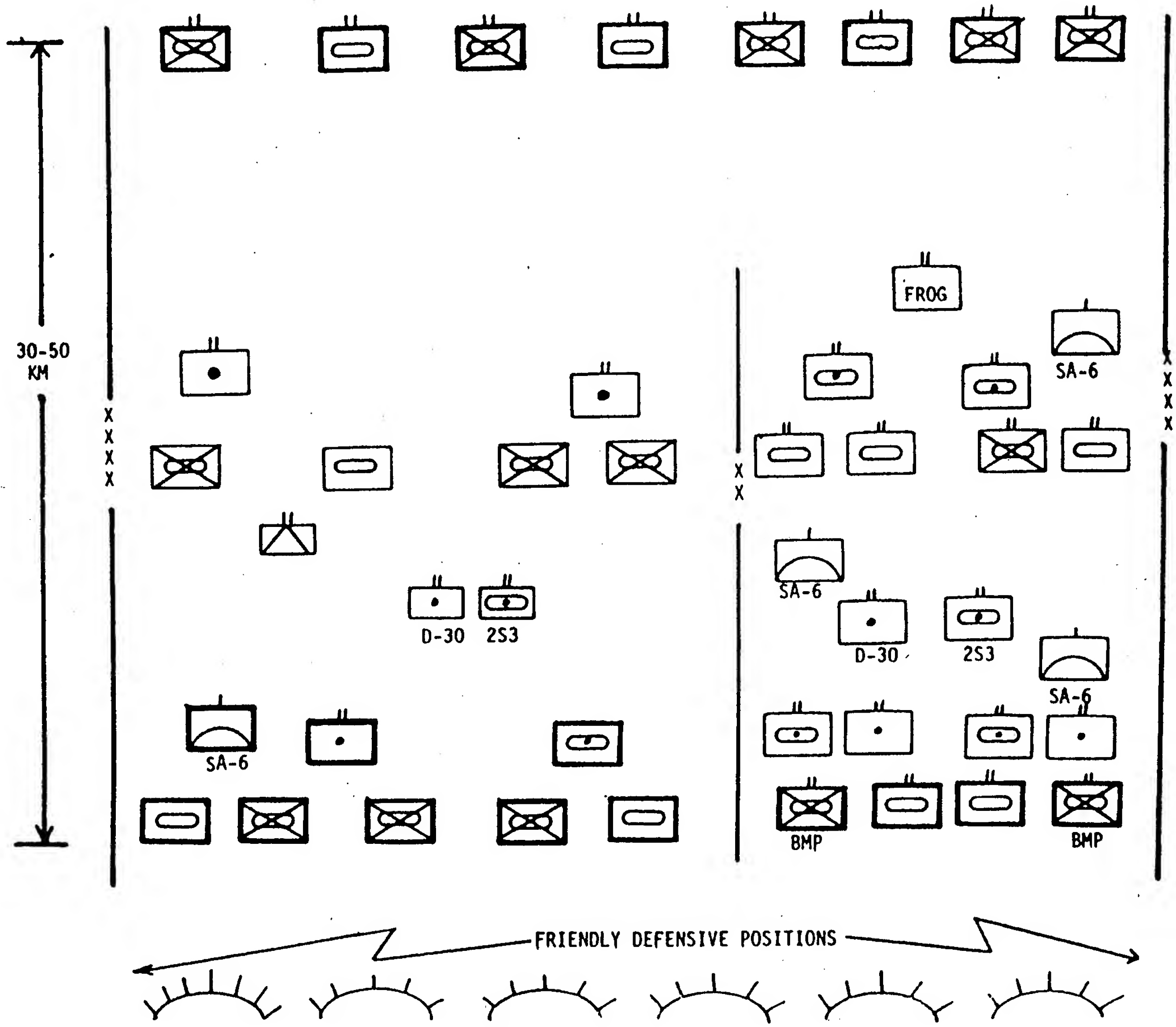
A. One motorized rifle division and one tank division in the first echelon and possibly two motorized rifle divisions in the second echelon. The threat main effort is on your right.

B. A motorized rifle division and a tank division in the first echelon and possibly two motorized rifle divisions in the second echelon. The threat main effort is on your left.

C. One motorized rifle division and one tank division in the first echelon and possibly one motorized rifle division and one tank division in the second echelon. The threat main effort is on your left.

D. Two motorized rifle divisions in the first echelon and possibly one motorized rifle division and one tank division in the second echelon. The threat main effort is on your right.

Not all units of the army have been located and therefore are not shown on the sketch map.



Sketch map A.

Friendly defensive positions

NOTE: You may write on this exam.

A-2-46

16. Soviet objectives in most offensive operations are-- (ELOs E.01, A.02)

A. Terrain oriented at all levels.

B. Terrain oriented at division level and below and force oriented at Army level and above.

C. Force or time oriented at all levels.

D. Force oriented at division level and below and terrain oriented at Army level and above.

17. The meeting engagement as a type of offensive action is used under which of the following conditions? (ELO E.01)

A. When the enemy defensive positions have not been located, forward movement has not yet been impeded, and continued movement is possible.

B. When the Soviet forces have been in contact, have lost their momentum, and are attempting to regain the initiative.

C. When contact has already been made and the enemy main defensive positions are known.

D. When the enemy defensive positions have been located and there is sufficient maneuver space between the forces to deploy.

18. During offensive operations, how would the Soviet division commander most likely employ his second-echelon force? (ELO E.01)

A. To ward off enemy counterattacks

B. To reinforce the first-echelon main effort if it is failing to achieve its objective.

C. To secure exposed flanks during the pursuit phase of the operation.

D. To exploit success of the first-echelon main effort.

19. The three types of offensive operations used by the Soviet forces are the-- (ELO E.01)

A. Meeting engagement, attack of a defending enemy, and pursuit.

B. Frontal attack, envelopment, and flank attack.

C. Meeting engagement, attack of a defending enemy, and exploitation.

D. Meeting engagement, deliberate attack, and envelopment.

20. When a Soviet commander constitutes a reserve-- (ELO E.01)

A. It will normally be given a specific mission.

B. It will only be a "pure" force as compared to a combined arms force.

C. It will normally be two levels smaller than the main force.

D. It will be committed only after the second echelon has been commited.

21. Which of the following best describes the concept of the army operational maneuver group (OMG)? (ELO E.02)

A. An additional force that is assigned to a combined arms army with the specific mission of conducting deep operations in the main attack sector.

B. A force formed from organic army assets that has the specific mission of conducting deep operations.

C. A motorized rifle division that will be used as a contingency force by the combined arms army commander on an as-needed basis.

D. A force composed of tank-pure units.

M310A/8
(Version A)

SPECIAL SITUATION

NOTE: Special situation and sketch map B pertain to item 22.

22. You are the corps G2 and your commanding general has issued guidance to prepare an attack order. From your intelligence map (sketch map B), you determine that the threat has one motorized rifle division defending in two echelons. How is the motorized rifle division organized? (ELO E.03)

A. There are three motorized rifle regiments in the first echelon and the tank regiment in the second echelon. The division artillery group is located in the center of the division sector, and RAGs do not appear to be with the first-echelon regiments. The division counterattack force appears to be a tank battalion.

B. There are two motorized rifle regiments in the first echelon and one motorized rifle regiment in the second echelon. The tank regiment is positioned as a counterattack force in an assembly area. There is a division artillery group located in the center of the sector and the regiment on the division east flank (US corps right flank) has a three-battalion RAG.

C. There are two motorized rifle regiments in the first echelon and the tank regiment and the other motorized rifle regiment in the second echelon. The division counterattack force appears to be a tank battalion located in the center of the division sector. Artillery appears to be evenly distributed throughout the sector.

D. There are two motorized rifle regiments in the first echelon and one motorized rifle regiment in the second echelon. The division has placed the tank regiment in an assembly area, and it is probably designated as the counterattack force. Artillery units are arrayed across the entire sector, and there does not appear to be a DAG.

25. Under which of the following conditions would you expect to see a Soviet unit revert to defensive operations? (ELO E.03)

(1) While awaiting additional resources.

(2) After securing the objective of the day.

(3) While consolidating gains.

(4) After securing the immediate objective.

(5) While regrouping after suffering severe losses.

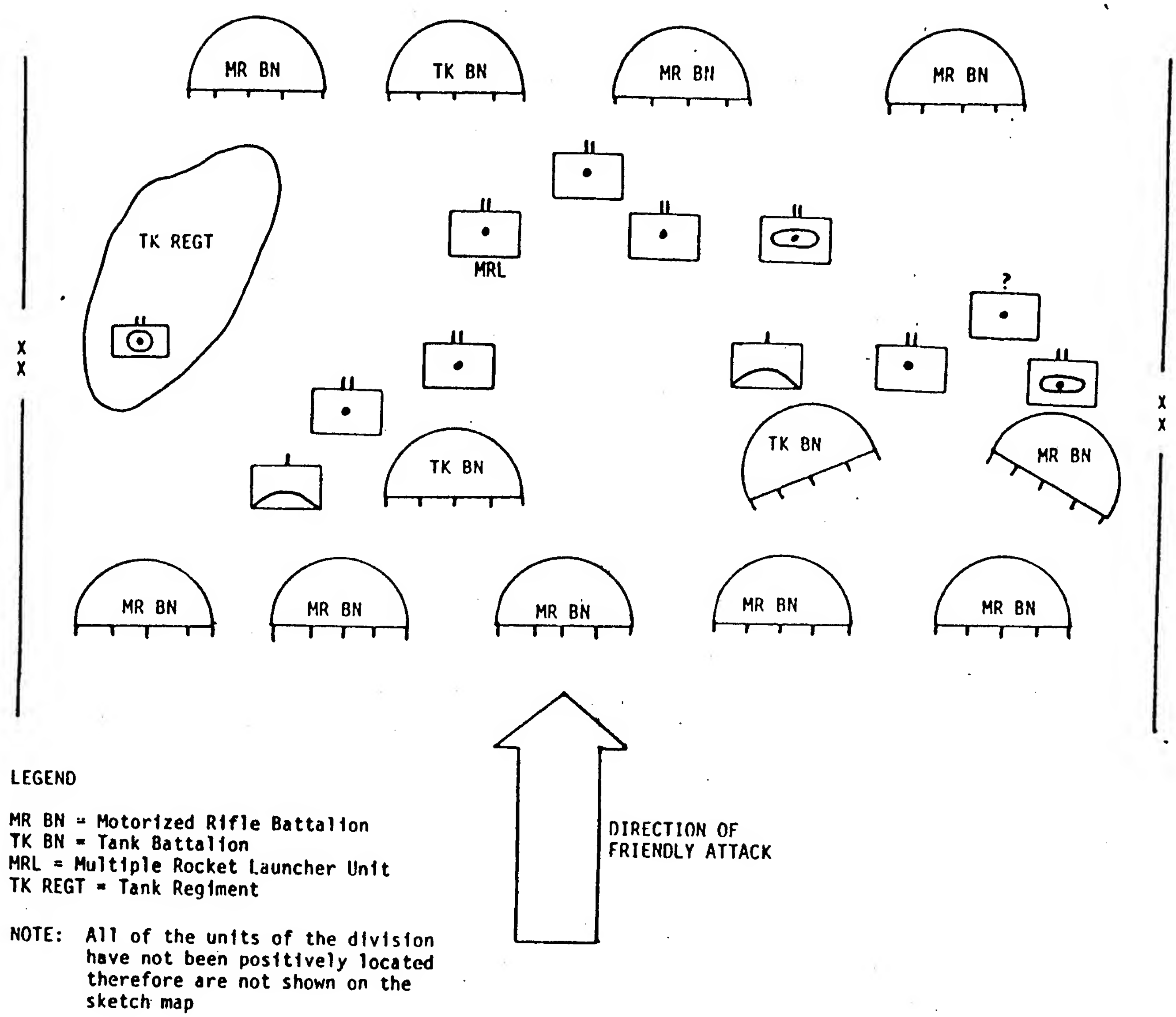
A. (1), (2), and (5).

B. (1), (3), and (5).

C. (2), (3), and (4).

D. (2), (4), and (5).

M310A/8
(Version A)



NOTE: All of the units of the division have not been positively located and therefore are not shown on the sketch map.

Sketch map B.

NOTE: You may write on this exam.

23. From the following list, select those actions that apply to the Soviet planner's organization for the defense. (ELO E.03)

(1) A motorized rifle division is usually assigned a frontage of 20 to 30 kilometers.

(2) The defense is organized in depth, using both obstacles and firepower.

(3) Obstacles are integrated into the defensive fire plan.

(4) The tank regiment is retained for use in a counterattack role.

(5) Forces are positioned in echelons.

A. (1), (2), (3), and (4).

B. (1), (2), (3), and (5).

C. (1), (2), (4), and (5).

D. (1), (2), (3), (4), and (5).

24. In describing Soviet defensive operations at the division level, one might say that-- (ELO E.03)

A. Tank forces are the principal counterattack force.

B. Motorized rifle forces are the principal counterattack force.

C. The antitank battalion of the motorized rifle division is the principal counterattack force.

D. A combined arms counterattack force is created using the reconnaissance battalion and motorized rifle and antitank units.

Name: ______________________________

FOR FACULTY USE ONLY UNTIL PRESENTATION

U. S. ARMY COMMAND AND GENERAL STAFF COLLEGE

ACADEMIC YEAR 1988-89

INSTRUCTIONS

1. Ensure that you enter your name on the line at the top of the examination. Record all answers in the space provided on the examination.

2. Check your examination booklet for any missing or defective pages. If you find any, contact the examination administrator.

3. Use pen or pencil to record your answers. (Please write clearly)

4. You have one hour to complete the examination.

FOR FACULTY USE ONLY UNTIL PRESENTATION

Name ________________________

Please answer the following questions in the spaces provided.

1. List the tenets of AirLand Battle.

2. Name the five function cycle in Intelligence Preparation of the Battlefield (IPB).

3. Name the elements of defensive battlefield framework.

4. Name four phases of offensive operations.

STUDENT QUESTIONNAIRE

Course Title ______________________________

Location ______________________________ Date __________

Name ______________________________ SSN __________

Please answer the following questions and return it to the class coordinator prior to leaving. This is NOT part of your course evaluation.

GENERAL INFORMATION

1. Age ______ 2. Component: Active Army USAR USANG DACIV

3. Rank/Grade __________ 4. Branch ______ 5. MOS/SC __________

6. Years of Comm Svc ______ 7. Job Title ______________________

8. Unit Location (City/State) ______________________________

9. Military Training Completed.

Basic ________	Officer Basic ________	DA Courses
AIT (MOS ________)	Advanced Course ________	________
PNCOC/PLC/PTC ________	CG&S ________	________
BNCOC/BTC ________	War College ________	________
ANCOC ________	CAS3 ________	________

10. Circle highest grade of civilian schooling and degree.

High School	9	10	11	12	Diploma/GED
College	13	14	15	16	AA; BS/BA
Graduate	17	18			MA/MS; PhD/EdD

11. Primary type and years of education/training experience.

Academic ______________ Business ______________
Technical ______________ General ______________

12. Reason for taking this course.

MOS Producing (MOS/SL/SC______________)
Sustainment/Refresher ______________
New Equipment Training ______________
Professional Development ______________

COURSE EVALUATION

13. On a scale of 0 to 10 with 5 being average, how would you rate the quality of this course?
(Low) 0 1 2 3 4 5 6 7 9 10 (High)

COURSE EVALUATION (Cont'd)

14. Do you feel you can perform the duties on which you were trained during this course?

Yes _____ No _____ Uncertain _____

15. How was the length of the course?

Too Short _____ About Right _____ Too Long _____

16. Were you able to ask questions and get satisfactory answers during the course?

Yes _____ (Number of Questions ___) No _____

Comments: ______________________________

17. If given the choice, would you take an interactive television course again?

Yes _____ No _____

Comments: ______________________________

TECHNICAL EVALUATION

18. How was the sound quality?

Good _____ Fair _____ Poor _____

19. How was the picture quality?

Good _____ Fair _____ Poor _____

20. Were there any major disruptions or interruptions during the course?

Yes _____ No _____

Comments: ______________________________

21. How was the in-class exercises and hands-on training?

Good _____ Fair _____ Poor _____

Comments: ______________________________

22. How easy was it to call the instructor?

Easy _____ Difficult _____ Don't Know _____

A-4-2 (Experimental Group Only)

ACCESS SURVEY ANSWER SHEET

COURSE TO BE SURVEYED | COURSE CODE

STUDENT NAME | STUDENT SSN

STUDENT NUMBER

MARKING INSTRUCTIONS

Read each question and its numbered answers. When you have decided on your response, blacken the corresponding space on this sheet with a No. 2 pencil. No stray marks, and ensure erasures are clean.

SAMPLE

DATA REQUIRED BY THE PRIVACY ACT OF 1974

AUTHORITY ... PRINCIPAL PURPOSE ... ROUTINE USES ... DISCLOSURE ...

MAKE NO MARKS BEYOND THIS LINE

QUESTIONS | RESPONSES

STRONGLY AGREE / AGREE / NEITHER AGREE NOR DISAGREE / DISAGREE / STRONGLY DISAGREE

1 I understood what was expected of me in this course
2 Time allotted was appropriate for amount of info presented
3 Teaching methods were most appropriate to achieving the TLOs
4 I received timely feedback on my classroom performance
5 I understood relation of this course to other CGSC instruction
6 Course topics were dealt with in sufficient depth
7 This course effectively challenged me to think
8 The goals of this course were consistently pursued
9 Students were encouraged to contribute to class learning
10 I was free to express and explain my own views in class
11 The instructor(s) developed classroom discussion skillfully
12 The climate of this class was conducive to learning
13 I recommend this course
14 Time required to complete homework was reasonable
15 Homework requirements were relevant to course
16 Homework assigned was necessary for better understanding
17 Adequate classroom time was allowed to complete PE's
18 PE allowed me to apply what I have learned
19 Exams accurately assessed what I learned in this course
20 Exams reinforced my learning
21 There was sufficient time for questions and discussions
22 Group work contributed significantly to this course
23 Assignments were related to goals of this course
24 The amount of material covered was reasonable
25 Directions for course assignments were clear and specific
26 Complexity and length of course assignments were reasonable
27 Course provided an opportunity to learn from other students
28 My instructor provided help where needed during PE's
29 Evaluation of the PE product was helpful
30 The instructor(s) recognized when students failed to comprehend
31 The instructor(s) held the attention of the class
32 The instructor(s) were helpful when students had problems
33 The course was well organized
34 Teleconferencing is a good instructional technique
35 The media package used is appropriate
36 The quality of transmission was adequate
37 I felt I was able to interact with other students
38 I felt I was able to interact with the instructor
39 I recommend the media package be used as a regular part of RC instr

(Response columns for items 1–42: SA | A | N | D | SD)

A-4-3 (Experimental)

ACCESS SURVEY ANSWER SHEET

COURSE TO BE SURVEYED	COURSE CODE

STUDENT NUMBER

STUDENT NAME	STUDENT SSN

MARKING INSTRUCTIONS

Read each question and its numbered answers. When you have decided on your response, blacken the corresponding space on this sheet with a No. 2 pen[illegible]. Make no stray marks, and ensure [illegible]

SAMPLE

1 I like ice cream

← MAKE NO MARKS BEYOND THIS LINE

RESPONSES: SA A N D SD

~~1 I understood what was expected of me in this course~~
2 Time allotted was appropriate for amount of info presented
3 Teaching methods were most appropriate to achieving the TLOs
4 I received timely feedback on my classroom performance
5 I understood relation of this course to other CGSC instruction
6 Course topics were dealt with in sufficient depth
7 This course effectively challenged me to think
8 The goals of this course were consistently pursued
9 Students were encouraged to contribute to class learning
10 I was free to express and explain my own views in class
11 The instructor(s) developed classroom discussion skillfully
12 The climate of this class was conducive to learning
13 I recommend this course
14 Time required to complete homework was reasonable
15 Homework requirements were relevant to course
16 Homework assigned was necessary for better understanding
17 Adequate classroom time was allowed to complete PE's
18 PE allowed me to apply what I have learned
19 Exams accurately assessed what I learned in this course
20 Exams reinforced my learning
21 There was sufficient time for questions and discussions
22 Group work contributed significantly to this course
23 Assignments were related to goals of this course
24 The amount of material covered was reasonable
25 Directions for course assignments were clear and specific
26 Complexity and length of course assignments were reasonable
27 Course provided an opportunity to learn from other students
28 My instructor provided help where needed during PE's
29 Evaluation of the PE product was helpful
30 The instructor(s) recognized when students failed to comprehend
31 The instructor(s) held the attention of the class
32 The instructor(s) were helpful when students had problems
33 The course was well organized

A-4-3 (Control)

5. Name the principal functions of command and control.

6. What are the three categories of tasks in the mission analysis?

7. List four of the five major tasks of the Soviet spetsnaz units in war.

8. Name the four phases of Soviet fire support of the attack.

9. Momentum in the attack and elasticity in the defense are tied to the tenet of ____________________.

10. __________________________ is a form of defense focusing on the retention of terrain by absorbing an eneny into an interlocking series of positions and destroying him primarily by fire.

11. Corps and divisions must plan to conduct mutually supporting operations simultaneously in three areas. Name these three areas.

12. __________________________ is generally the least economical form of offensive maneuver since it exposes the attacker to the concentrated direct fires of the defender.

13. Why is the intelligence preparation of the battlefield (IPB) conducted?

14. The four templates used in the IPB process are _________________, _________________________, ____________________________, and ____.

15. In accordance with ST100-9, the stated mission becomes what paragraph of the Operations Plan or Operations Order?

16. In accordance with ST100-9, what is the result of a Commander's mission analysis?

17. What is the ultimate goal of course of action development during the command estimate process?

18. What are the primary functions of a corps or division main command post?

19. The type of organization that will coordinate a 50km road movement from the port area (CONSIGNOR) to the origin rail terminal and then coordinate the destination (CONSIGNEE) capability to receive and off-load the shipment is a

________________________________.

20. Who determines the corps medical evacuation policy?

21. The commander's priorities for allocation and replacement of weapons systems within a division should be based on ______________________________________.

22. How many hours in advance do you request tactical air reconnaissance?

23. Who has the responsibility for the allocation of sorties?

24. What is the primary role of tank forces in Soviet defensive operations at division level?

25. How large will the Soviet reserve forces be in relation to the main force?

CAPITAL INVESTMENT COSTS
WORKSHEETS

1. Sunk Costs

	CONTRACTOR OWNED		GOVERNMENT OWNED			
	Number/Rate	Total to Date	Number	To Date	In Construction	Total
A. Facilities (Fixed Costs)						
(1) Send Site (IVT)						
(2) Recieve Site (IVT)						
(3) Training—Classroom (All)						
(4) Production (All)						
(5) Training Development and Administration (All)						
(6) Storage/Warehousing (All)						
(7) ______						

	CONTRACTOR OWNED			GOVERNMENT OWNED		
	To Date	Scheduled	Total Fee	To Date	Ordered	To Date
B. Equipment (Fixed Costs)						
(1) Send Site						
(2) Receive Site						
(3) Training—Classroom						
(4) Production						
(5) Training Development and Administration						
(6) Storage/Warehousing						
(7) ______						

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	To Date	Scheduled	Total Fee	To Date	Ordered	To Date
C. Technical Supplies						
D. Equipment Installation and Technical Support						

2. Research & Development Costs (Fixed Costs)

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	To Date	Planned	Total R&D	To Date	Planned	Total R&D
A. Facilities						
B. Prototype Equipment						
C. Technical Supplies						
D. Personnel Costs (Recruitment, Retention, Training; Travel, etc.)						
E. Systems Development (Development, Design, Testing, Evaluation)						
F. Equipment Installation and Technical Support						
G. __________						

3. Programmed Investments (Beyond R&D) (Variable Cost Based Upon Assumptions)

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Number	Cost Per	Total	Number	Cost Per	Total
A. Facilities						
(1) Send Sites						
(2) Receive Site						
(3) Training-Classroom						
(4) Production						
(5) Training Development and Administration						
(6) Storage/Warehousing						
(7) __________						

3. Programmed Investments (Beyond R&D)
(Variable Cost Based Upon Assumptions)
(Continued)

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Number	Cost Per	Total	Number	Cost Per	Total
B. Equipment						
(1) Send Sites						
(2) Receive Sites						
(3) Training—Classroom						
(4) Production						
(5) Training Development and Administration						
(6) Storage/Warehousing						
(7) ________						
C. Technical Supplies						
D. Equipment Installation and Technical Support						
D. Personnel Costs (Recruitment, Retention, Training, Travel, etc.)						
E. ________						

OPERATING AND OVERHEAD COSTS
WORKSHEETS

	Contractor Provided: Per Course	Contractor Provided: Monthly Rate	Contractor Provided: Yearly Rate	Government Provided: Per Course	Government Provided: Monthly Rate	Government Provided: Yearly Rate
A. Facilities—Rental/Fee/ Maintenance (Variable Cost)						
(1) Send Site (IVT)						
(2) Receive Site (IVT)						
(3) Training—Classrooms (All)						
(4) Production Facilities (All)						
(5) Training Development and Administration Facilities (All)						
(6) Storage/Warehousing (All)						
(7) ____________						
(8) ____________						
B. Equipment Rental/Fee/ Maintenance (Variable Cost)						
(1) Send Site (IVT)						
(2) Receive Site (IVT)						
(3) Training—Classrooms (All)						
(4) Production Facilities (All)						
(5) Training Development and Administration Facilities (All)						
(6) Storage/Warehousing (All)						

OPERATING AND OVERHEAD COSTS
WORKSHEETS

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Per Course	Monthly Rate	Yearly Rate	Per Course	Monthly Rate	Yearly Rate
B. Equipment Rental/Fee/ Maintenance (Variable Cost) (Continued)						
(7) ______						
(8) ______						
C. Utilities (Variable Cost)						
D. Material and Supplies (Variable Cost)						
E. Communications Services (Variable Cost)						
(1) Telephone						
(2) ______						
(3) ______						
F. Commercial Services (Variable Cost)						
(1) Mail/Federal Express						
(2) Travel						
G. Overhead (Variable Cost)						
(1) General Administrative						
(2) ______						
(3) ______						

TRAINER AND PRODUCTION STAFF COSTS
WORKSHEETS

	CONTRACT PERSONNEL			GOVERNMENT PERSONNEL		
	Per Course	Monthly Rate	Yearly Rate	Per Course	Monthly Rate	Yearly Rate
A. Salary (Per course is Variable Cost)						
(1) Course Director						
(2) Course Specialist/ Subject Matter Expert						
(3) Education Specialist/ Training Developers (TD)						
(4) Instructional Designers						
(5) Technical Writers						
(6) Editors						
(7) Graphics - CAD Operators						
(8) Media Specialist/Production Assistants						
(9) Engineers						
(10) Technicians						
(11) Producers/Directors						
(12) Instructors						
(13) Training Assistants						
(14) ____________________						
B. Trainer Development (Variable Cost)						
(1) Training Courses						
(2) Training Materials						
(3) ____________________						
C. Other						
(1) ____________________						
(2) ____________________						

COURSE DEVELOPMENT COSTS (Development & Production)

WORKSHEETS (Development is Fixed Cost. Production is Variable Cost)

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Per Course	Monthly Rate	Yearly Rate	Per Course	Monthly Rate	Yearly Rate
A. Audiovisuals						
(1) Films						
(2) Slides						
(3) Graphics						
(4) Videos						
(5) CBI						
(6) ____________						
B. Written Materials						
(1) Student Readings						
(2) Advanced Sheets						
(3) Worksheets - Handouts						
(4) ____________						
C. Training Aids						
(1) Mock-ups						
(2) Simulators						
(3) ____________						
D. Faculty and Trainer Materials						
(1) Training Requirements Analysis						
(2) Training and Evaluation Outlines						
(3) Lesson Plans						
(4) Course Scripts						
(5) Administration Instructions						
(6) ____________						

COURSE DEVELOPMENT COSTS (Development & Production)

WORKSHEETS (Development is Fixed Cost. Production is Variable Cost)

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Per Course	Monthly Rate	Yearly Rate	Per Course	Monthly Rate	Yearly Rate
E. Evaluations						
(1) Student Tests						
(2) Questionnaires						
F. Other						
(1) ______						
(2) ______						
(3) ______						

COURSE DELIVERY COSTS
WORKSHEETS

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Per Course	Monthly Rate	Yearly Rate	Per Course	Monthly Rate	Yearly Rate
A. Transmission Costs (IVT) (Variable Cost)						
(1) Transponder Time						
(2) Ground Segment						
(3) ____________						
B. Communication Costs (If not included in operating and overhead costs) (Variable Cost)						
(1) Phones/Speakers/Microphones						
(2) Lines						
C. Training Facility (If not included in the operating and overhead costs)						
(1) Fee/Rental						
(2) Utility Costs						
(3) ____________						
D. Equipment (If not included in the Operating and Overhead costs)						
(1) Fee/Rental						
(2) Maintenance Costs						
(3) ____________						

COURSE DELIVERY COSTS
WORKSHEETS

	CONTRACTOR PROVIDED			GOVERNMENT PROVIDED		
	Per Course	Monthly Rate	Yearly Rate	Per Course	Monthly Rate	Yearly Rate
E. Student Costs (Σ Number Students X Rate) (Fixed Costs)						
(1) Travel						
(2) Per Diem						
(3) Salary						
(4)						
F. Other						

CAPITAL INVESTMENTS SUMMARY SHEET

	RCIIMS	RESIDENCE	ACCP
1. Sunk Costs			
A. Facilities			
(1) Contractor Fees			
(2) Government Purchases			
(3) In Construction			
SUBTOTAL			
B. Equipment			
(1) Contractor Fees			
(2) Government Purchases			
(3) Ordered			
SUBTOTAL			
C. Technical Supplies			
(1) Contractor Fees			
(2) Government Purchases			
(3) Supplies Ordered			
SUBTOTAL			
D. Equipment Installation and Technical Services			
(1) Contractor Fees			
(2) Government Provided			
(3) Services Ordered			
SUBTOTAL			
TOTAL SUNK COSTS			
2. Research and Development			
A. Facilities			
(1) Contractor Fees			
(2) Government Provided			
SUBTOTAL			
B. Prototype Equipment			
(1) Contractor Fees			
(2) Government Provided			
SUBTOTAL			

CAPITAL INVESTMENTS SUMMARY SHEET

	RCIIMS	RESIDENCE	ACCP	
C. Technical Supplies				
(1) Contractor Fees				
(2) Government Provided				
SUBTOTAL				
D. Personnel Costs				
(1) Contractor Fees				
(2) Government Provided				
SUBTOTAL				
E. Systems Development				
(1) Contractor Fees				
(2) Government Provided				
SUBTOTAL				
F. Equipment Installation and Technical Support				
(1) Contractor Fees				
(2) Government Provided				
SUBTOTAL				
G. Other				
(1)				
(2)				
SUBTOTAL				
TOTAL R&D				
3. Programmed Investments				
A. Facilities				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
B. Technical Supplies				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				

CAPITAL INVESTMENTS SUMMARY SHEET

	RCIIMS	RESIDENCE	ACCP	
C. Technical Supplies (1) Contractor Provided (2) Government Provided				
SUBTOTAL				
D. Equipment Installation and Technical Support (1) Contractor Provided (2) Government Provided				
SUBTOTAL				
TOTAL PROGRAMMED INVESTMENTS				
TOTAL CAPITOL INVESTMENT				

OPERATING AND OVERHEAD COSTS - SUMMARY SHEET PER COURSE/YEAR

	RCIIMS	RESIDENCE	ACCP
I. Operating Costs			
A. Facilities - Rental/Fee/ Maintenance			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
B. Equipment - Rental/Fee/ Maintenance			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
C. Utilities			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
D. Material and Supplies			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
E. Communication Services			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
F. Commercial Services			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
G. Overhead			
(1) General Administration			
SUBTOTAL			
H. Other			
SUBTOTAL			
TOTAL OPERATING AND OVERHEAD COSTS PER COURSE/PER YEAR			

TRAINER AND PRODUCTION STAFF COSTS - SUMMARY SHEET
PER COURSE/YEAR

	RCIIMS	RESIDENCE	ACCP	
A. Salaries				
(1) Contract Labor				
(2) Civilian Personnel				
(3) Military Personnel				
SUBTOTAL				
B. Trainer Development				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
C. Other				
SUBTOTAL				
TOTAL TRAINER AND PRODUCTION STAFF COSTS PER COURSE/PER YEAR				

COURSE DEVELOPMENT COSTS - SUMMARY SHEET
PER COURSE/YEAR

	RCIIMS	RESIDENCE	ACCP	
A. Audiovisuals				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
B. Written Materials				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
C. Training Aids				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
D. Facility and Trainer Material				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
E. Evaluations				
(1) Contractor Provided				
(2) Government Provided				
SUBTOTAL				
F. Other				
SUBTOTAL				
TOTAL COURSE DEVELOPMENT COSTS PER COURSE/YEAR				

COURSE DELIVERY COSTS - SUMMARY SHEET
PER COURSE/YEAR

	RCIIMS	RESIDENCE	ACCP
A. Transmission Costs (IVT)			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
B. Communication Costs			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
C. Training Facilities			
(1) Contractor Provided			
(2) Government Provided			
SUBTOTAL			
D. Equipment			
(1) Contractor Provided			
(2) Government Provided			
(3) Services Ordered			
SUBTOTAL			
E. Student Costs			
(1) All Students			
SUBTOTAL			
F. Other			
(1)			
SUBTOTAL			
TOTAL PROGRAM DELIVERY COST PER COURSE/PER YEAR			

TRAINING COST COMPARISON SHEET
PER COURSE/YEAR

	RCIIMS	RESIDENCE	ACCP	
I CAPITOL INVESTMENTS				
1. Sunk Costs				
2. Research and Development Costs				
3. Programmed Investments				
SUBTOTAL				
PRORATION FACTOR (PF) COURSE/ YEAR				
SUBTOTAL				
II OPERATING AND OVERHEAD COSTS				
III TRAINER AND PRODUCTION STAFF COSTS				
IV COURSE DEVELOPMENT COSTS				
V COURSE DELIVERY COSTS				
SUBTOTAL II - V (Plus PF if not included in Operating & Overhead Costs)				
STUDENT HOURS (STUDENT X HOURS)				
COST PER STUDENT HOUR (Σ II-V/STUDENT HOURS)				
$\bar{X}$ TRAINING EFFECTIVENESS				
TRAINING EFFICIENCY (X TRAINING EFFECTIVENESS/ COST PER STUDENT HOUR)				

TRAINING COST COMPARISON SHEET
IVT USAGE ASSUMPTIONS

	I	II	III	IV
I CAPITOL INVESTMENTS 1. Sunk Costs 2. Research and Development 3. Programmed Investments				
SUBTOTAL				
PRORATION FACTOR				
SUBTOTAL				
II OPERATING AND OVERHEAD COSTS				
III TRAINER AND PRODUCTION STAFF COSTS				
IV COURSE DEVELOPMENT COSTS				
V COURSE DELIVERY COSTS				
SUBTOTAL II-V (Plus PF if not included in Operating and Overhead Costs)				
STUDENT HOURS (STUDENTS X HOURS)				
COST PER STUDENT HOUR (Σ II-V/STUDENT HOURS)				
$\bar{X}$ TRAINING EFFECTIVENESS				
TRAINING EFFICIENCY (X TRAINING EFFECTIVENESS/ COST PER STUDENT HOUR)				

BIBLIOGRAPHY

COMPUTER CONFERENCING APPLICATIONS

Anonymous. (1986). From Cave Drawings to Computer Conferencing. Business Software Review 86-32812 V5 N8, P16-17.

Anonymous. (1985). More Uses for Computer Conferencing. EDP Analyzer 85-30235 V 23 N8, P1-12.

Anonymous. (1986). Computers in the Executive Suite: Teleconferencing. Small Business Report 85-14337 V10 N2, PF74.

Babcock, C. (1985). Remote Mirrors Connects for Electronic Meetings. Computerworld.

Baldwin, Lionel V. (1984). An Electronic University. IEEE Spectrum 85-02565 N11, P108-110.

Barnhardt, C. (1984). "Let Your Fingers Do the Talking" Computer Communication in an Alaska Rural School. Washington, DC: National Institute of Education.

Blankenhorn, Dana. (1986). Is Computer Conferencing Finally Beginning to Mature? Business Communications Review 86-30233 V16 N4, P18-22.

Burstyn, H. Paris. (1986). Encounters of the Electronic Kind. Network World 86-35961 V3 N30, P37-38.

Cary, James S.; Parnes, Robert; et al. (1983). "Computer-Assisted Teleconferencing - Togetherness With A Difference", Military Chaplains's Review.

Cary, James S. (1982). "A Department of Army Command and Control Information Management System." University of Louisville.

Cary, James S. A Command and Control Subsystem for the United States Readiness Command - A Macrosystems Solution. (Unpublished).

Chess, David M., Cowlishaw, Mike F. (1987); A Large Scale Computer Conferencing System. IBM Systems Jrnl 87-20890 V26 N1, P138-153.

Cross, T. B. (1984). Computer Conferencing. Computerworld on Communications. 18, 31A, pp 37-39.

Cross, T. B. (1982). Computer Teleconferencing--Virtual Networking. Gaithersburg, MD: Proceedings of the Computer Networking Symposium.

Cross, T. B. (1983). Computer Teleconferencing: The Meeting that Keeps on Meeting. Training, 20, 5.

Cross, T. B. (1984). Computer Conferencing. Computerworld on Communications, 18, 31A.

Cross, T. B. (1983). Learning Without Going There. Education via Computer Teleconferencing. Cross Information Company.

Dow, J. (1983). Communications and Conferencing Software for Anthropology. Paper presented at The Annual Meeting of the American Anthropological Association, Chicago, IL.

Eldridge, J. R. (1982). New Dimensions in Distant Learning. Training and Development Journal, pp. 43-47.

Ellis, G. B. and Keenan, T. P. (1983). Micro-Computers, Videotex, and Educational Teleconferencing. Proceedings of the International Conference on Applications of Mini-and-Micro-computers in Information, Documentation, and Libraries, Tel-Aviv, Israel.

Fano, R. M. (1985/March). Computer-Mediated Communication. IEEE Technology and Society Magazine, 4, 1, pp. 3-6.

Feenberg, Andrew. (1986). Network Design: An Operating Manual for Computer Conferencing. IEEE Transactions on Professional Communication 86-12022 VPC 29 NI, P2-7.

Feenberg, A. (1986). Network Design: An Operating Manual for Computer Conferencing. IEEE Transactions on Professional Communications Vol. PC 29, No. 1, pp. 2-7.

Flanin, R. A.; Williford, J.D. and Barzilai, H. (1986). Computer Conferencing Data Structures in the Grandiose System. IEEE Transactions on Professional Communications, PC 29.

Flanin, R. A.; Williford, J. D. and Barzilai, H. (1986). Computer Conferencing Data Structures in the GRANDiose System. IEEE Transactions on Professional Communication 86-12-28 VPC 29 NI P34-44.

Fowler, G. P. and Wackerbarth, M. E. (1980). Audio Teleconferencing Versus Face-to-Face Conferencing: A Synthesis of the Literative. Western Journal of Speech Communication. 44, p. 236-252.

Garrison, D. R. (1985). Three Generations of Technological Innovations in Distance Education. Distance Education, 6(2).

Gilbert, A. M. (1983). Reach Out, Reach Out and Beep Someone. Case Currents, 9, 3.

Graves, B. E. (1984). Distance Learning-Are You Ready? American School and University. 57,4, p. 53.

Greenly, Mike. (1987). Interactive Journalism and Computer Nerworking: Exploring a New Medium. Futurist 87-10157 V21 N2, P12-16.

Haile, P. J. and Richards, A. J. (1984). Supporting the Distance Learner with Computer Teleconferencing. Paper presented at the 15th Annual Convocation of the Northeastern Educational Research Association, Ellenville, New York.

Hammond, S. (1978/Summer). Tele-Education at the Open University. Journal of Communication, 28, 3, pp. 141-148.

Hellueg, S. A.; Berman, S. J. and Smith, A. F. (1985). Emerging Organizational Electronic Communication Technologies: A Selected Review of the Literature. Paper presented at the Speech Communication Association Convention, Denver, CO.

Hiltz, S. R. (1978/Summer). The Computer Conference. Journal of Communication, 28, 3, pp. 157-163.

Hiltz, S. R. and Turoff, M. (1985). Structuring Computer-Mediated Communication Systems to Avoid Information Overload. Communications of the ACM. 28, 7, pp. 680-689.

Hiltz, S. R. and Turoff, M. (1981). The Evolution of User Behavior in a Computerized Conferencing System. Communications of the ACM. 24, 11, pp. 739-751.

Hiltz, S. R.; Johnson, K.; Aronovitch, C. and Turoff, M. (1980). Face-to-Face vs. Computerized Conferences: A Controlled Experiment. (Research Report Number 12), Newark, New Jersey: NJIT Computerized Conferencing & Communications Center.

Hiltz, S. R.; Kerr, E. B. and Johnson, K. (1985). Determinants of Acceptance of Computer-Mediated Communication Systems: A Longitudinal Study of Four Systems. Final Technical Report to the National Science Foundation (DCR 8121865).

Hiltz, S. R.; Johnson, K. and Turoff, M. (1985). The Effects of Formal Human Leadership and Computer-Generated Decision Aids on Problem Solving Via Computer: A Controlled Experiment. (Research Report Number 21), Newark, New Jersey: NJIT Computerized Conferencing & Communications Center.

Hiltz, S. R.; Johnson, K. and Turoff, M. (1982). The Effects of Formal Human Leadership and Computer-Generated Decision Aids on Problem Solving Via Computer: A Controlled Experiment. (Research Report Number 18), Newark, New Jersey: NJIT Computerized Conferencing & Communications Center.

Hutzel, I. (1985). PC-Based Presentation Graphics; A Look at Eight Key Players. Computer Graphics World. 8, pp. 62-64.

Jainschigg, J. (1985). The Computer Cafe. Family Computing, 3.

Johansen, R. and DeGrasse, R. (1979/Summer). Computer-Based Teleconferencing: Effects on Working Patterns. Journal of Communication, 29.

Johnston, J. (1985). Computers and the Schools: The Next Decade. Washington, DC: The National Institute of Education.

Kemezis, Paul. (1985). Academic Network Weaving, Path Through Europe. Data Communications 85-06635 V14 N1, P56,58.

Kerr, E.B. (1986). Computerized Conferencing & Communications Center. (Performance Report), New Jersey: New Jersey Institute of Technology.

Kerr, E.B. (1986). What is EIES? Computerized Conferencing & Communications Center. New Jersey: New Jersey Institute of Technology.

Kerr, E. B. (1984). Moderating Online Conferences. (Research Report Number 20), Newark, New Jersey: NJIT Computerized Conferencing & Communications Center.

Kerr, Elaine B. (1986). Electronic Leadership: A Guide to Moderating Online Conferences. IEEE Transactions on Professional Communication 86-12024 VPR 29 NI, P12-18.

Kurland, N. D. (1983). Have Computer, Will Not Travel: Meeting Electronically. Phi Delta Kappan. 65, pp. 124-126.

Levinson, C. Y. (1984). The School Problem-Solver's Guide to Distance Education. Austin, Texas: Southwest Educational Development Laboratory.

Levinson, P. (1986). Marshall McLuhan and Computer Conferencing. IEEE Transactions on Professional Communications, 29(1).

Licklider, J.C.R. and Vezza, A. (1978). Applications of Information Networks. Proceeding of the IEEE. 66,11, PP. 130-146.

Livingston, D. (1984). Computer Conferencing. Datamation. pp. 111-116.

Malone, Dandridge. (1982). X=H. Fort Monroe, VA: HQ, TRADOC.

Manock, J.J. (Editor). (1984). Computer-Mediated Conferencing Systems and Their Potential Impact on Educations. Conference Proceedings, Exxon Education Foundation & University of North Carolina at Wilmington.

Marosits, Mark J. and Graber, Marla M. (1984). The Connecting Point: Vendor Access-a-Guide to the New Health Care Technologies. Hospital Forum 85-01024 V27 N6, PS6-16.

Meeks, B. (1985). An Overview of Conferencing Systems. Byte, 10,13.

Mellow, Craig. (1985). Life Is Discovered at the Source. Across the Board 85-24718 V22 N7/8, P50-55.

Michkoff, Henry C. (1986). The Network Nation Emerges. Management Review 86-27625 V75 N8, P29-31.

Mills, M. K. (1983/April). Computer Conferencing for the Third World: Readings for the Future. Paper presented at the 7th Annual Conference of the International Studies Association, Mexico City, Mexico.

Moskalud, P.; Moore, J. W. and Moore, E. A. (1984/85). CHYMNET, A New Wave of Communication: Computerized Conferencing. Computers in Mathematics and Science Teaching.

Myers, Sumner, (President). (1985). Looking into Education's High-Tech Future, Bethesda, MD: Harvard Magazine, University Tech-Tel Corporation.

Newell, A. and Sproull, R. F. (1982). Computer Networks: Prospects for Scientists. Science. Vol. 215, pp. 843-852.

(No Authorship). (1985/April). Conferencing Tool for IBM Micros Out. Computerworld.

O'Flaherty, Thomas. (1986/February). Multiuser Age Raises Issues. Computerworld 85-07791 V19 N5, P37, 52.

Opper, Susanna. (1984/November). Computer Based Messaging: Keep Corporate Teams on Target. Computer Decisions 85-03834 V16 N15, P100-112.

Palme, J. (1985). Conferencing Standards. Byte, 10, 13.

Parker, L. H. (1985). Teleconferencing in Education. Syracuse, NY: ERIC Digest.

Pearson, M. M. L. and Kulp, J. E. (1981). Creating an Adaptive Computerized Conferencing System on UNIX. Proceedings of the IFIP International Symposium on Computer Message Systems, Ottowa, Canada.

Peterson, L. L. and Comer, D. E. (1985). Conversations: An Alternative to Memos and Conferences. In Computer Conferencing and Electronic Messaging Conference Proceedings, Guelph, Ontario, Canada.

Phillips, A. F. and Pease, P. S. (1985/May). Computer Conferencing and Education: Complementary or Contradictory Concepts? Paper presented at the 35th Annual Meeting of the International Communication Association, Honolulu, HI.

Price, C. R. Conferencing via Computer: Cost Effective Communication of the Era of Forced Choice. In H. A. Linstone & M. Turoff (Eds), the Delphi Method: Techniques and Applications. Reading, MA: Addison-Wesley. (no date).

Pullinger, D. J. (1986). Chit Chat to Electronic Journals: Computer Conferencing Supports Scientific Communication. IEEE Transactions on Professional Communication 86-12026 VPC 29 NI, P23-29.

Pyle, I.C. (1985). Uses for Computer Conferencing. Data Processing (UK) 86-01192 V27 N8, P30-33.

Rasmussen, Thomas A.; Flower, Joe; Williamson, Bobette; McManus, Robert P.; Whitney, Robert V.; Coile, Russell C. Jr.; Longe, Mary E.and Dizon, John O. (1984). Video Teleconferencing: Education Live via Satellite/Prescription Television: Educating Patients During Hospital Stays/ Interactive Computer Systems for Health Care Educators/Computer Conferencing: A Technology Ahead of Its Users. Hospital Forum 85-01025 V27 N6, PS17-S22.

Richards, A. J. (1986). On Line Communications: Distance Learning for the Nontraditional Adult Learner. New York Institute of Technology.

Ruchinskas, J. E. (1983). Predictors of Media Utility: Influences on Managers' Perceptions of Business Communication Systems. Paper presented at the International Communication Association Convention, Dallas, TX.

Schroeder, R. E. (1981). Computer Conferencing: Exploding the Classroom Walls. Technological Horizons in Education, 8, 2.

Scollon, S. (1981/December). The Teacher-Student Role in Instructional Telecommunications. Paper presented at the Annual Meetings of the American Anthropological Association, Los Angeles, CA.

Shenton, K. E. and Landsberg, M. K. (1981). Conference Searching at 1200 Baud. Online, pp. 42-43.

Siegel, J.; Dubrovsky, V.; Kiesler, S. and McGuire, T. W. (1986). Group Processes in Computer-Mediated Communication. Organizational Behavior and Human Decision Processes, 37, pp. 157-187.

Spangler, K.; Lipinski, H. and Plumner, R. (1979). Interactive Monitoring of Computer-Based Group Communication. Paper submitted to the National Computer Conference, New York, NY.

Spencer, Bill and Opperman, Bonnie. (1986). Survival in an Age of Networking: Selecting the Right Software for PC Based Networking. Words 86-13391 V14 N5, P26-27,46.

Spitzer, Michael. (1986). Writing Style in Computer Conferences. IEEE Transactions on Professional Communication 86-12025 VPC 29 NI, P19-22.

Stewart, D. (1985). Computer Conferences. Business Computer Systems, 4, 4.

Stewart, Doug. (1985). Computer Conferences Come to Order. Business Computer Systems 85-16534 V4 N4, P80-84.

Tapscott, D. (1982). Investigating the Electronic Office. Datamation, pp. 130-138.

Teleconferencing (no authorship). (1985). Teleconferencing. Small Business Report, 10, 1.

Tinterow, M. M. (1984/November). Traditional and Nontraditional Educational Elements Using Telecommunications. Paper presented at the National Adult Education Conference, Louisville, KY.

Turner, J. A. (1983). Private Company to Offer 170 Courses by Computer in Electronic University. The Chronicle of Higher Education, 27, 4.

Turoff, M. (1982). On the Design of an Electronic University. Telecommunication and Higher Education Conference Briefs, New Jersey.

Turoff, M. and Hiltz, S. R. (1986/May). Remote Learning: Technologies & Opportunities. World Conference on Continuing Engineering Education.

Uhlig, R. P.; Farber, D. J. and Bair, J. H. (1979). The Office of the Future. Amsterdam: North Holland Publishing Company.

Walker, L. (1984). Graphics From Here to There. Personal Computing, 8, 12.

Wallace, Bob. (1986/July). ITI Wires Users into Factory Resources. Network World 86-28089 V3 N20, P15-16.

Williams, E. (1978/Summer). Social and Psychological Factors. Teleconferencing: Journal of Communication. 28, 3, pp. 125-131.

Winn, B.; Ellis, B.; Platter, E.; Sinker, L. and Potter, G. (1986). The Design and Application of a Distance Education System Using Teleconferencing and Computer Graphics. Educational Technology. 26, 1, pp. 19-23.

Zimmerman, John L. (1987/June/July). Developing a Geriatric Information System Bulletin of ASIS 87-23139 V13 N5, P18-19.

AUDIO TELECONFERENCING APPLICATIONS:

Baird, Marcia A. (1983). Teleconferencing in Wisconsin: Adding Freeze-Frame Highlights 18th. In Lorne A. Parker & Christine H. Ogren (Eds.), Teleconferencing and Electronic Communication. (pp. 106-115). Madison, WI: University of Wisconsin Extension.

Baker, R. O. and Pepe, K. A. (1983). A Bridging System with Remote Customer Control. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 174-177). Madison, WI: University of Wisconsin Extension.

Bateman, Thomas B. (1983). Microphones and Audio Teleconference Equipment. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 184-188). Madison, WI: University of Wisconsin Extension.

Benning, Marjorie. (1983). Bridging the Last Frontier: The Learn/Alaska Instructional Telecommunications Networks. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 141-148). Madison, WI: University of Wisconsin Extension.

Bevan, Darrell and Threlkeld, Robert. (1983). Making Teleconferencing Stick. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 245-250), Madison, WI: University of Wisconsin Extension.

Biswas, Pheru and Use and Cukier, Wendy. (1983). Promotion of Teleconferencing by the Ontario Government: A Ministry of Government Services Perspective. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 125-133), Madison, WI: University of Wisconsin Extension.

Boese, J. O., Mearnes, A. B., Metz, R., and Huttenhoff, J. H. (1983). In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 159-164). Madison, WI: University of Wisconsin Extension.

Boone, Mary, E. and Bassett, Ronald E. (1983). Training People to Audioconference: A Review of the Current Wisdom. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 333-341). Madison, WI: University of Wisconsin Extension.

Boudle, Jim. (1983). Coaching Teleconferencing Users. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 313-323), Madison, WI: University of Wisconsin Extension.

Bransford, Louis A. and Southworth, Glen. (1983). MAG*NET - An Audiographic Cooperative Network - A Viable Option at Last. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Eletronic Communication. (pp. 223-227). Madison, WI: University of Wisconsin Extension.

Braucher, Bettye Hill. (1983). Teleteaching: Interaction on a Shoestring. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 64-72). Madison, WI: University of Wisconsin Extension.

Braucher, Bettye, Hill. Teleteaching: Interaction on a Shoestring. Tucson Unified School District, Tucson, Arizona.

Cordes, Donald L. and Smith, Steven R. (1983). Developing a Multiple Production/Multiple Receiving Station Interactive Audio Teleconferencing Network. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 24-29), Madison, WI: University of Wisconsin Extension.

Cowan, Robert and Haskell, Sterling. Computer Assisted High Speed Switching for Multi-Site Full Motion Video Systems. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 227-231). Madison, WI: University of Wisconsin Extension.

Cowan, Robert and Niemiec, Anne. (1983). Evaluation Considerations When Documenting Teleconferencing Cost-Benefits. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 290-293), Madison, WI: University of Wisconsin Extension.

Cross, Thomas, B. (1983). Learning Without Going There: Education via Computer Tele/Conferencing. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 358-366), Madison, WI: University of Wisconsin Extension.

Curwin, Robert. (1983). Implementation Factors in Freeze Frame Teleconferencing. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 231-235). Madison, WI: University of Wisconsin Extension.

Daniel, John, S. (1983). Worldwide Trends in Distance Education: New Technologies for Interaction. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (p. 392), Madison, WI: University of Wisconsin Extension.

Eisen, D. J. (1983). Teleconferencing Human Factors Testing. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 164-174), Madison, WI: University of Wisconsin Extension.

Evans, Ann S. and Otte, Gwendolyn. (1983). Audio Conferencing - A Delivery System for Education. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 64-72). Madison, WI: University of Wisconsin Extension.

Fahl, Lisel A. (1983). Teletraining in the Corporate Environment. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 87-94), Madison, WI: University of Wisconsin Extension.

Fahl, Lisel, A. Teletraining in the Corporate Environment. Cincinnati, Ohio: AT&T Long Lines.

Fischell, David R., Weinglass, Ieon, and Piete, Richard. (1983). Bridging the Needs of the 80's: The Ouorum Teleclass and Teleconferencing. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 188-198), Madison, WI: University of Wisconsin Extension.

Fischer, Lynn M. (1983). Video Teleconferencing Control Systems: The Case of Fairchild Industries. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 227-231), Madison, WI: University of Wisconsin Extension.

Gold, Elliot, M. (1983). Teleconferencing Trends in the Past Year: An Overview. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 380-382). Madison, WI: University of Wisconsin Extension.

Goodfriend, Kathleen, K. and Bamberger, Nancy, J. (1983). KPBS Interactive Videotex Project. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 345-353). Madison, WI: University of Wisconsin Extension.

Graham, Edward, Jr. and Baine, Mary. (1983). So What Else is New? Demystifying the Satellite Mystique. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 231-234), Madison, WI: University of Wisconsin Extension.

Greenwood, James, L. (1983). The Panasonic Interactive Video Training System: Analysis of Interactive Video Training Through a Dedicated Video Tape Based System. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 366-380), Madison, WI: University of Wisconsin Extension.

Gunter, Pauline. (1983). Training Community Information Specialists via the Learn/Alaska Telecommunications Network: A Report on a Proposal. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 283-290). Madison, WI: University of Wisconsin Extension.

Hancock, Burton, W., Chute, Alan, G. and Raszkowski, Robert, R. (1983). Training for Teleconference Instructors. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 228-233), Madison, WI: University of Wisconsin Extension.

Harris, John D. (1983). Audiographic Teletraining Experiences within the AT&T Long Lines Accounts and AT&T Long Lines Finance Training. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 82-87). Madison, WI: University of Wisconsin Extension.

Harris, John D. Audiographic Teletraining Experiences within AT&T Long Lines Accounts and Finance Training. Piscataway, New Jersey: AT&T Long Lines.

Hayes, J. W. (1983). The Audio and Audiographics Teleconferencing Market. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 156-159). Madison, WI: University of Wisconsin Extension.

Hoffman, Clifford J. and McKinney, William A. ATMC. (1983). The Multi-Media ATMC, The Multi-Media Teleconferencing System. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 206-214). Madison, WI: University of Wisconsin Extension.

Hudson, Heather, E. (1983). Planning a Teleconferencing Network for a Statewide University System. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 250-254), Madison, WI: University of Wisconsin Extension.

Huffman, Stanley, A., Jr. (1983). A Multiple Delivery System: An Innovative Approach to Off Campus Instruction. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 263-273), Madison, WI: University of Wisconsin Extension.

Hugdahl, Edward, O. (1983). Developing Curricula for Orgaists in Small Churches Using the Distance Learning Mode. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 302-313), Madison, WI: University of Wisconsin Extension.

Johansen, Robert. (1983). What Teleconferencing Might Become. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 382-387), Madison, WI: University of Wisconsin Extension.

Johnson, James W. (1983). Canadian Plans for an International Hybrid Teleconferencing Service. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 120-125), Madison, WI: University of Wisconsin Extension.

Keiper, Robert. (1983). Teleconferencing User Training: A Program for Industry. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 323-328), Madison, WI: University of Wisconsin Extension.

Klenke, Maggie and Ostendorf, Virginia. (1983). United Banks of Colorado: A TeleConferencing Case Study. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication, (pp. 1-6). Madison, WI: University of Wisconsin Extension.

Kruh, Jan. (1983). Student Evaluation of Instructional Teleconferencing. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 293-302), Madison, WI: University of Wisconsin Extension.

Lunkenheimer, Erik K. (1983). Video-Graphic Conferencing: The Power of High Performance Interactive Audio graphics with Freeze Frame and Full Motion Conferencing. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 100-106), Madison, WI: University of Wisconsin Extension.

McMeen, George, R. (1983). Using Rhetoric and Meaningful Context in a Teleconferencing Program. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 320-345), Madison, WI: University of Wisconsin Extension.

Mitroff, Donna D. and Eichelberger, R. T. (1983). Teleconferencing: A Tool for Knowledge Diffusion in Education. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 273-283), Madison, WI: University of Wisconsin Extension.

Montone, Wayne V. and Miller, Richard K. (1983). Telesis (Acoustical Treatment of Teleconferencinc Rooms), In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 214-223), Madison, WI: University of Wisconsin Extension.

Pease, Pamela S. (1983). Long Distance Training for Maine and New Hampshire's Vocational Rehabilitation Counselors. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 39-45), Madison, WI: University of Wisconsin Extension.

Pereyra, Susan G. (1983). Audio Teleconferencing as a Marketing Device Connex International. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 7-14), Madison, WI: University of Wisconsin Extension.

Pereyra, Susan G. (1983). Conducting Business Meetings by Teleconferencing and Interactive Media. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 64-72), Madison, WI: University of Wisconsin Extension.

Prem, David C. and Dray, Susan M. (1983). Teleconferencing at Honeywell. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 73-82), Madison, WI: University of Wisconsin Extension.

Prem, David, C. and Dray, Susan, M. Teleconferencing at Honeywell. Minneapolis, Minnesota: Honeywell, Inc.

Renschler, Evans, S. Ann and Otte, Gwendolyn. (1983). Audio conferencing-A Delivery System for Education. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 45-53), Madison, WI: University of Wisconsin Extension.

Reymer, Arnold, S. (1983). Marketing Videotex to Meet Consumer Needs. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 353-358), Madison, WI: University of Wisconsin Extension.

Roberge, Louise. (1983). Conference 500TM - Today's Way to Teleconference. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 94-100), Madison, WI: University of Wisconsin Extension.

Roberge, Louise. Conference 500TM - Today's Way to Teleconference. Toronto, Ontario: Bell Canada.

Roeder, Susan D. (1983). Application of Teleconferencing to Health Care Roche Laboratories. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 19-24), Madison, WI: University of Wisconsin Extension.

Sanders, Joyce L.; Webb, Linda J. and Baer, Peter. (1983). Teleducation in Texas: Continuing Education for Mental Health Professionals. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 30-39), Madison, WI: University of Wisconsin Extension.

Schultz, Harvey S. (1983). System Testing for Audio Bridge Quality. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 198-202), Madison, WI: University of Wisconsin Extension.

Silverman, George. (1983). Using Audio Teleconferencing for Sales and Marketing: How to Accelerate the Teleconference Network Adoption Process. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 14-18). Madison, WI: University of Wisconsin Extension.

Stockbridge, Christopher and Fischer, David P. (1983). CoutumTM Teleconferencing: A Meeting of Minds. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 177-184), Madison, WI: University of Wisconsin Extension.

Swift, David W. (1983). Teaching with Freeze Frame Video in Hawaii. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 115-120), Madison, WI: University of Wisconsin Extension.

Tone, Daniel J. and Muse, Charles T. (1983). The Use of Multi-Media Equipment for Interactive Telecommunications. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 152-156), Madison, WI: University of Wisconsin Extension.

Whipp, Dave and Molinaro, Dave. (1983). Development of a Human Services Satellite Training Network: Survivor's Story. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 133-141), Madison, WI: University of Wisconsin Extension.

Winders, Ray and Watts, John. (1983). Teleconferencing - A Case Study for a Major Project in the U.K. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 53-64). Madison, WI: University of Wisconsin Extension.

Zenner, Hal B. (1983). Human Factors Design of the QuorumTM Teleconferencing Bridge. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 202-206), Madison, WI: University of Wisconsin Extension.

Zuckernick, Arlene and Hraghey, Margaret. (1983). Using an Audio Teleconferencing Bridge to Enhance Live Satellite-Based Instruction in British Columbia. In Lorne A. Parker & Christine H. Olgren (Eds.), Teleconferencing and Electronic Communication. (pp. 148-152), Madison, WI: University of Wisconsin Extension.

VIDEO CONFERENCING APPLICATIONS:

Acharya, Lena; Miranda, Jaime; and Diasanta, Nestor. (1987). Distance Education. Manila, Philippines: Asian Development Bank, Volume II.

Aeronautical Systems Division; Staff Study Systems Division. (1978). Maintenance Training Simulator Procurement. Wright-Patterson Air Force Base, OH: Air Force Systems Command.

Anastasi, Anne. (1982). Psychological Testing. New York: Macmillan Publishing Co. Inc.

Army Productions. (1985). DOD Directives, DOD Directive 5040.2-C-1, Catalog of Audio-Visual Productions Vol. I.

Army Regulations (AR 5-5, AR 350-1). (1981 & 1983). Army Studies and Analysis, Army Training. C1, AR 5-5, AR 350-1.

Assistant Secretary of Defense (Comptroller). (1983). FDYP, The Five-Year Defense Program. Washington, DC: Fiscal Year 1984 Budget, Summary and Program Element Detail, Update.

Assistant Secretary of Defense (Comptroller). (1972). Economic Analysis and Program Evaluation for Resource Management. Washington, DC: Department of Defense Instruction No. 7041.3.

Assistant Secretary of Defense (Comptroller). (1981). Accounting Guidance Handbook. Washington, DC: Department of Defense Handbook 7220.9-H.

Assistant Secretary of Defense (Comptroller). (1982). Budget Guidance Manual. Washington, DC: Deputy Assistant Secretary of Defense (Program/Budget), DoD 711-1-M.

Assistant Secretary of Defense (Comptroller). (1977). Uniform Budget/Cost Terms and Definitions. Washington DC: Department of Defense Instruction No. 5000.33.

Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics). (1983). Military Manpower Training Report for FY 1984. Washington, DC.

Balsley, Howard C. (1968). Introduction To Statistical Method. Totowa, NJ: Littlefield, Adams and Co.

Baum, David R.; Clark, Chriss T.; Coleman, Patrick; Lorence, Steve, and Persons, Warren. (1979). Maintenance Training System: 6883 Converter/Flight Control Test Station. Brooks Air Force Base, TX: Air Force Human Resources Laboratory, AFHRL-TR-78-87.

Behm, A. N.; Johnson, D.C.; Graf, C.P.; Hirshfeld, S.; and McAlleese, K. (1980). Army Maintenance Training and Evaluation System (AMTESS). Minneapolis, MN: Honeywell, Inc., Systems and Research Center, (Draft, Honeywell proprietary) 3 Volumes.

Betaque, N.E., and Fiorello, M.R. (1977). Aircraft System Operating and Support Costs: Gudelines for Analysis. Washington, DC: Logistics Management Institute.

Biersner, R.J. (1975). Attitudes and Other Factors Related to Aviation Maintenance Training Effectiveness. CNETS Report 6-75, (Platt 1976).

Biersner, Robert J. (1976). Observations on the Use and Evaluation of ECII-LP Simulators for Aviation Training. Pensacola, FL: Chief of Naval Education and Training Support, CNETS Report 2-76.

Blair, D., and Maron, M.E. (1985). Communications of the ACM 28. "An evaluation of retrieval effectiveness for a full-text document-retrieval system," No. 3, 289.

Bond, Nicholas A. and Towne, Douglas H. (1979). Troubleshooting Complex Equipment in the Military Services: Research and Projects. Redondo Beach, CA: Behavioral Technology Laboratories, University of Southern California, Technical Report No. 92.

Breckons, Walt. (1987). Video Teletraining Case Study. U.S. Army Corps of Engineers, GS-11, Project Officer.

Briggs, L.J.; Besnard, G.G. and Walker, E.S. (1955). An E-4 Fire Control System Performance Test: I Functional Description. Lowry Air Force Base, CO: Technical Memorandum ASPRL TM-55-8, Air Force Personnel and Training Research Center, (AD 72585).

Brown Board Survey. (1966). Department of the Army Board of Inquiry on the Army Logistics.

Brown, Harold. (1981). Report of Secretary of Defense to the Congress on the Fiscal Year 1982 Budget.

Buchan, Lt. Col. Toss S. and Knutson, Maj. Roy. (1977). "The ITDT Program: The Army Departs from Training Tradition," Defense Management Journal. pp. 33-37.

Cantor, Joan H. and Brown, Judson S. (1956). An Evaluation of the Trainer-Tester and Punchboard Tutor as Electronics Troubleshooting Training Aids. Port Washington, L.I., NY: Technical Report NAVTRADEVCEN 1257-2-1, U.S. Naval Training Device Center, (AD 15706).

Chase, Clinton I. (1967). Elementary Statistical Procedures. New York: McGraw-Hill Inc.

Cicchinelli, L.F.; Harmon, K.R.; Keller, R.A. and Kottenstette, J.P. (1980). Relative Cost and Training Effectiveness of the 6883 Three-Dimensional Simulator and Actual Equipment. Brooks Air Force Base, TX: Air Force Human Resources Laboratory, AFHRL-TR-80-24.

Condon, C.F.M.; Ames, L.L.; Hennessey, J.R.; Shriver, E.L. and Seeman, R.E. (1979). Flight Simulator Maintenance Training; Potential Use of State-of-the-Art Simulation Techniques. Brooks Air Force Base, TX: Air Force Human Resources Laboratory, AFHRL-TR-79-19.

Cost Analysis Improvement Group. (1980). Aircraft Operating and Support Cost Development Guide. Washington, DC: Office of the Secretary of the Secretary of Defense.

Cowlishaw, M.F. (1984-85). The REXX Language. , also, "The design of the REXX language," IBM Systems Journal Englewood Cliffs, NJ: Prentice-Hall, Inc., 23, No. 4, 326-335

Cox, J.A.; Wood, R.O.; Boren, L.M. and Thorne, H.W. (1965). Funcutional and Appearance Fidelity of Training Devices for Fixed-Procedures Tasks. Alexandria, VA: Human Resources Research Organization, Technical Report 65-4.

Crowder, Norman A. (1957). A Part-Task Trainer for Troubleshooting. Lackland Air Force Base, TX: Air Force Personnel and Training Research Center, AFPTRC-TN-57-71, (AD 131423).

Cunningham, C.E. (1980). Technology Assessment of Human Factors Engineering in the Air Force. "Human Factors in Maintainability (M) Design and Analyses" in Robert C. Williges and Donald A. Topmiller. Report of an Independent Study Team to the Air Force System Command.

Cunningham, D.J. (1977). Electronic Maintenance-Training Analysis and Course Design. Teddington, Middlesex: Admiralty Research Laboratory, ARL/APU/R10.

DA Handbooks. (1983). Military Occupational Speciality Training Cost Handbook (MOSB).

Dallman, B.E.; DeLeo, P.J.; Main, P.S. and Gillman, D.C. (1977). Evaluation of PLATO IV in Vehicle Maintenance Training. Lowry AFB Division CO, AFHRL-TR-77-59.

Daniels, R.W.; Datta, J.R.; Gardner, J.A. and Modrick, J.A. (1975). Feasibility of Automated Electronic Maintenance Training (AEMT), Vol. I, Design Development and Evaluation of an AEMT/ALQ-100 Demonstration Facility. Warminster, PA: Naval Air Development Center, NADC 75176-40. (AD A020873).

Daniels, Richard W. and Cronin, J.R. (1975). Feasibility of Automated Electronic Maintenance Training (AEMT), Vol. II, Cost Analysis. Warminster, PA: Naval Air Development Center, Code 4024, Report No. NADC 74-C-0111-2, (AD A016681).

DA Pam 351-20. (1983). Army Correspondence Course Catalog. Washington, DC: DA Pamphlets.

Darst, H. Jackson. (1974). Evaluation of EC II Simulator. Fort Eutis, VA: Research Memoradum 3-75, U.S. Army Transportation School, (Platt 1976).

David W. Taylor Naval Ship Research and Development Center. (1977). Navy Technical Information Presentation Program. Bethesda, MD: TM 186A-77-1.

Davis, Duane and Cogenza, Robert M. (1985). Business Research For Decision Making. Boston: Kent Publishing.

Defense Science Board. (1976). Summary Report of the Task Force on Training Technology. Washington, DC: Office of the Director of Defense Research and Engineering.

Defense Science Board. (1974). Report of the Task Force on Electronics Management. Washington, DC: Office of the Director of Defense Research and Engineering.

Defense Science Board. (1982). Summer Study on Training and Training Technology. Washington, DC: Office of the Under Secretary of Defense Research and Engineering.

Department of Defense. (1968). Work Breakdown Structures for Defense Materiel Items. Washington, DC: MIL-STD-881.

Department of Defense. (1979). Military Manpower Requirements Report for FY 1980. Washington, DC.

Department of Defense. (1980). Military Manpower Training Report for FY 1981. Washington, DC.

Denenberg, Victyor H. (1954). The Training Effectiveness of a Tank Hull Trainer. Alexandria, VA: Human Resources Research Office, Technical Report 3, (AD 26012).

Department of the Air Force, AFM 50-2. (1975). Instructional Systems Development. Washington, DC: Headquarters, U.S. Air Force.

Department of the Air Force, AFR 173-13. (1983). USAF Cost and Planning Factors. Washington, DC: Headquarters, U.S. Air Force.

Department of the Army. (1987). Army Training Support (ATS). Fort Eustis, Virginia.

Department of the Army, AR 37-18. (1971). Weapon/Support Systems Categories and Elements. Washington, DC: Headquarters, U.S. Army.

Department of the Army. (1976). Research and Development Cost Guide for Army Materiel Systems. Washington, DC: Headquarters, U.S. Army, Pamphlet No. 11-2.

Department of the Army. (1976). Investment Cost Guide for Army Materiel Systems. Washington, DC: Headquarters, U.S. Army, Pamphlet No. 11-3.

Department of the Army. (1987). Interactive Video Teletraining (IVT) Management Plan. Fort Monroe, VA: TRADOC Circular 351-87-2.

Department of the Army. (1976). Operating and Support cost Guide for Army Materiel Systems. Washington, DC: Headquarters, U.S. Army, Pamphlet No. 11-4.

Department of the Army. (1981). Task Report for Development of Cost Estimating Relationships (CER) for Support of the Enhanced Cost Collection System (Task 5). Orlando, Florida: Project Manager for Training Devices.

Department of the Navy. (1980). Navy Civilian (Civil Service) Billet Costs--FY 80: An Interim Report. San Diego, California: Navy Personnel Research and Development Center, NPRDC SR 80-19.

Department of the Navy. (1983). Cost and Schedule Estimating System (CSES). Orlando, Florida: Naval Training Equipment Center (Systems Engineering Division).

DePauli, J.F. and Parker, E.L. (1969). The Introduction of the Generalized Sonar Maintenance Trainer into Navy Training for an Evaluation of its Effectiveness. Orlando, FL: Naval Training Device Center, NAVTRADEVCEN 68-C-0005-1, (AD 69060 4).

Division of Planning and Research. (1986). Statistical Handbook 1984,Statistics on Higher Education in Sri Lanka. Colombo: University Grants Commission.

Dorn, P.; Giblin, T. and Zeliff, K. (1981). MVS/System Product Release 3 Function and Performance Overview. GG22-9418, IBM Corporation; available through IBM branch offices.

Dougherty, D.J.; Houston, R.C. and Nicklas, D.R. (1957). Transfer Of Training in Flight Procedures from Selected Ground Training Devices to the Aircraft. Port Washington L.I., NY: Technical Naval Training Device Center, Report NAVTRADEVCEN 71-16-16.

Dressel, Douglas J. and Shields, Joyce L. (1979). Organizational Maintenance Performance. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, Research Problem Review 79-8, (AD A076638).

Dyer, Jean R. (1979). Understanding and Evaluating Educational Research. Reading, Mass: Addison-Wesley Co.

Elliott, T.K. (1967). The Maintenance Task Simulator (MTS-2): A Device for Electronic Maintenance Research, Volume I: Application and Operation, AMRL-TR-67-140. Wright-Patterson Air Force Base, OH: Aerospace Medical Research Laboratories, (AD 664085).

Fink, C. and Shriver, Dennis and Edgar. (1978). Simulators for Maintenance Training: Some Issues, Problems and Areas for Future Research. Brooks Air Force Base, TX: Air Force Human Resources Laboratory, AFHRL-TR-78-27, (AD A060088).

Fink, C. and Shriver, Dennis and Edgar L. (1978). Maintenance and Training Simulators at Air Force Technical Training Centers: Present and Potential Use. Brooks Air Force Base, TX: Air Force Human Resources Laboratory, AFHRL-TR-78- 77.

Fiorello, M. (1975). Estimating Life-Cycle Cost: A Case Study of the A-7D. Santa Monica, CA: The Rand Corporation, R-1518-PR, (AD 102808).

Flavin, R.A.; Williford, J.D. and Barzilai, H. (1986). IEEE Transactions on Professional Communication PC-29. "Computer conferencing data structures in the GRANDiose System," No. 1, 34-44.

Foley, J.P. (1977). Performance Measurement of Maintenance. Brooks Air Force Base, TX: Air Force Human Resources Laboratory, AFHRL-TR-77-76, (AD A053475).

Ford, John D. Jr. and Slough, Dewey A. (1970). Development and Evaluation of Computer-Assisted Instruction for Navy Electronic Training: I. Alternating Current Fundamentals. San Diego, CA: Navy Personnel and Training Research Laboratory, Research Report SSR 70 32.

Ford, John D. Jr.; Slough, Dewey A. and Hurlock, R.E. (1972). Computer Assisted Instruction in Navy Technical Training Using a Small Dedicated Computer System. San Diego, CA:Final Report, Navy Personnel and Training Research Laboratory, Research Report SSR 73, (AD 752999).

French, R.S. and Martin, L.B. (1957). A Flight-Line Troubleshooting Trainer for a Complex Electronic System: The MAC-2 Trainer. Lackland Air Force Base, TX: Air Force Personel and Research Center, Development Report AFPTRC-TN-57-106.

Frost and Sullivan, Inc. (1979). The Military and Aerospace Trainer and Simulator Market. New York, NY.

Frost and Sullivan, Inc. (1979). The Non-U.S. Trainer and Simulator Market. New York, NY.

Gagne, R.M. (1962). Training Research and Education. "Simulators" in R. Glaser (Ed.) Pittsburgh, PA: University of Pittsburgh Press.

Gates, Howard P.; Gourary, Barry S.; Deitchman, Seymour J.; Rowan, Thomas and Weimer, David C. (1974). Electronics-X: A Study of Military Electronics With Particular Reference to Cost and Reliability. Arlington, VA: Institute for Defense Analyses, Two volumes, Report R-195.

General Accounting Office. (1978). The Key to Improving Maintenance of Army Equipment: Commanders Must Motivate Their Personnel. Washington, DC: U.S. General Accounting Office, LCD-78-428.

General Electric Ordnance Systems. (1975). Computer-Based Instruction Evaluation Project, Final Report, Vol. 1: Conduct and Results of the Computer-Based Instruction Evaluation. Pittsfield, Pittsfield, MA.

Giunti, F.E. and Longo, A.A. (1971a). An Evaluation of CAI in Basic Electronics Training. Stony Brook, NY: Report presented to the Association for the Development of Instructional Systems at the State University of New York at Stony Brook.

Giunti, F.E. and Longo, A.A. (1971b). An Interim Evaluation of the Tutorial Mode of CAI in Army Basic Electronics Training. Grossinger, NY: Report presented at the Annual Convention of the Northeastern Educational Research Association.

Glass, Albert Allen. (1967). Problem-Solving Techniques and Troubleshooting Simulators in Training Electronic Repairmen. Ann Arbor, MI: Columbia University, University Microfilms, Inc., Ph.D. dissertation, 67-12, 252.

Gold, David; Kleine, Bruce; Fuchs, Frank; Ravo, Sal and Inaba, Kay. (1980). Aircraft Maintenance Effectiveness Simulation (AMES) Model: Final Report, Technical Report. Orlando, FL: Naval Training Equipment Center, NAVTRAEQUIPCEN 77-D-0028-1, (draft).

Grimsley, Douglas L. (1969). Acquisitiion, Retention and Retraining: Effects of High and Low Fidelity in Training Devices. Alexandria, VA: Human Resources Research Office, Technical Report 69-1, (AD 685074).

Gunaratne, Indrance Herat. (1982). "Some Thoughts in Educational Broadcasting in Sri Lanka," Media Asia.

Hair, Joseph F. Jr.; Anderson, Ralph, E.; Tatham, Ronald L. and Grablowsky, Bernie J. (1979). Multivariate Data Analysis. Tulsa, Oklahoma: PPC Books,

Halasz, F. and Moran, T. (1982). Proceedings of Human Factors in Computer Systems. "Analogy considered harmful," pp. 383-386.

Hamburg, Morris. (1977). Statistical Analysis for Decision Making Second. New York: Harcort Brace Javanovich Inc.

Hannaman, D.L.; Freeble, L.A. and Miller, G.G. (1978). Description of the Air Force Maintenance Training Device Acquisition and Utilization Processes. Brooks AFB, TX: Air Force Human Resources Laboratory, AFHRL-TR-78-28.

Harris, W.P.; Frossberg, M.; Downs, A.B.; Johnson, 2nd Lt. L.E.; Barnes, MSgt. T.W. and Clark, H.M. (1972). Keesler Test of Lincoln Training System (LTS) Feasibility. Keesler AFB, MS: KE PR 72 112.

Herrick, R.M.; Wright, J.B. and Bromberger, R.A. (1977). Simulators in Aviation Maintenance Training: A Delphi Study. Warminster, PA: Naval Air Development Center, NADC-78015-60, (AD A052715).

Herringa, L.; Koch, C.; Persons, W.; Daniels, R.W.; Pine, S. and Squires, C. System Specification for the Three-Dimensional Unit of the Electronic Equipment Maintenance Training (EEMT) System. (Honeywell Report F2210-5), Minneapolis, MN: Honeywell, Inc., Systems and Research Center, (no date).

Hiltz, R. and Turroff, M. (1985, July). Communications of the ACM-28, "Structuring computer-mediated communications systems to avoid information overload," No. 7, 680.

Hiltz, R. and Kerr, B. (1982). Computer-Mediated Communications Systems: Status and Evaluation. New York: Academic Press, Inc.

Holbert, C. and Newport, G. (1975). Helicopter Maintenance Effectiveness Analysis. (USAAMRDL-TR-75-14), Fort Eustis, VA: Eutis Directoratate, U.S. Army Air Mobility Research and Development Laboratory, (AD A012225).

Hopf-Weichal, R.; Purcell, D.; Freedy, A. and Lucaccini, L. (1979). Adaptive Decision Aiding in Computer-Assisted Instruction: Adaptive Computerized Training System (ACTS). (Annual Technical Report PATR 1076-79-11), Woodland Hills, CA: Perceptronics, Inc.

Horowitz, S.A. and Sherman, A. (1977). Crew Characteristics and Ship Condition (Maintenance Personnel Effectiveness Study (MEPS)). (CNS 1090), Arlington, VA: Center for Naval Analyses, (AD A050404).

Hritz, R.J. and Purifoy, G.R. (1980). Maintenance Training Simulator Design and Acquisition. (AFHRL-TR-80-23), Brooks Air Force Base, TX: Air Human Force Resources Laboratory.

IBM Corporation. IBM Virtual Machine/System Product--CMS User's Guide. (SC19-6250), available through IBM branch offices.

IBM Corporation. Virtual Machine/System Product Introduction. (GC-196200), available through IBM branch offices.

IBM Corporation. IBM System/38--Introduction. (GC21-7728), available through IBM branch offices.

Integrated Technical Documentation and Training (ITDT). (1978/July-August). Army Research, Development and Acquisition Magazine.

International Business Machines Corporation. (1968). A Feasibility Study of Computer-Assisted Instruction in U.S. Army Basic Electronics Training. (Final report, Contract No. DAAB 07 76 C 0578), Gaithersburg, MD.

Interservice Training Review Organization. Services Standard Training Course Costs. Proposed Joint Regulation/Instruction/ Order, undated, but current as of February 1983.

Interservice Training Review Organization. Services Standard Training Course Cost Procedures Handbook. Draft, to implement the proposed Joint Regulation/Instruction/Order, undated, but current as of February 1983.

Interservice Training Review Organization. (1975). Interservice Procedures for Instructional Systems Development. Executive Summary and Model, NAVEDTRA 106A.

Jayawardana, W.A. (1972-1978). A Review of an Experiment. University of Sri Lanke: External Services Agency.

Jewell, Elmer M. and Webman, Kenneth I. (1979). Reduction of No-Defect Maintenance Study. (Report 2-30104/9R-52146), Dallas, TX: Maintainability Engineering Group, Vought Corporation, (AD B042456).

Johnson, W.B. (1980). Computer Simulation in Fault Diagnosis Training: An Empirical Study of Learning Transfer from Simulation to Live System Performance. (Report T0101), University of Illinois-Urbana, IL: Coordinated Science Laboratory.

Johnson, W.B.; Rouse, S.H. and Rouse, W.B. (1980). An Annotated Selective Bibliography on Human Performance in Fault Diagnosis Tasks. (Technical Report 435), Alexandria, VA: Army Research Institute.

Johnson, W.L. and Reel, R.E. (1973). Maintainability/Reliability Impact on System Support Costs. (AFFDL-TR-73-152), Wright Patterson Air Force Base, OH: Air Force Flight Dynamics Laboratory, Air Force Systems Command.

Joint Technology Coordinating Group. (1978/December). Report of the JTCG Sub-Group for Maintenance Simulation. (draft).

Keesler Air Force Base. (1972). Training High-Aptitude Self-Paced Students on the Lincoln Training System (LTS), KE PR 72-118. Keesler AFB, MS.

Keesler Air Force Base. (1973). Suppelmentary Study of Peer Training with the Lincoln Training System. (KE PR 73-123), Keesler AFB, MS.

Kiesler, S.; Siegel, J. and McGuire, T.W. (1984). American Psychologist 39. "Social psychological aspects of computer-mediated communication," No. 10, 1123-1134.

King, W. (1978). New Concepts in Maintenance Training Aviation Engineering and Maintenance. (2(6)).

Kinkade, R.G. and Wheaton,S. (1972). Human Engineering Guide to Equipment Design. "Training Device Design," in H.P. Van Cott and R.G. Kinkade (Eds.), Washington, DC: U.S. Government Printing Office.

Kline, M.B. and Almog, R. (1979). Avionics Reliability, Its Techniques and Related Disciplines. "Application of the Lognormal Distribution to Corrective Maintenance Down Times in C. Jacobsen," (Ed.) (AGARD Conference Proceedings No. 261), Neuilly sur Seine, France: Advisory Group for Aerospace Research and Development, (AD A080301).

Knapp, Mark I. and Orlansky, Jesse. (1983). A Cost-Effectiveness Structure for Defense Training. (IDA Paper P-1709), Alexandria, VA: Institute for Defense Analyses.

Kulshreshtha, O.P. (1979/September). Technical Education Experiences of the Sri Lanka Institute of Distance Education. Paper presented at the International Seminar on Distance Education, Addis Ababa, 3-15.

Longo, A.A. (1969). The Implementation of Computer-Assisted Instruction in U.S. Army Basic Electronics Training: Follow-up of a Feasibility Study. (TR-69-1), Ft. Monmouth, NJ: U.S. Army U.S. Army Signal Center and School.

Longo, A.A. (1972). A Summative Evaluation of Computer-Assisted Instruction in U.S. Army Basic Electronics Training. (TR 72-1), Ft. Monmouth, NJ: Army Signal Center and School.

Lumsdaine, A.A. (1960). Human Factors Methods for System Design. "Design of Training Aids and Devices," in J.D. Folley (Ed.) Pittsburgh, PA: American Institute for Research.

Matur, R.S. (1984). Non-Formal Education Programme in Sri Lanka: Proposals for Monitoring the Literacy Compoment. (A Consultancy Mission Report), India: Ministry of Education and Culture.

McGuirk, F.D.; Pieper, W.J. and Miller, G.G. (1975). Operational Tryout of a General-Purpose Simulator. (AFHRL-TR-75-13), Broods Air Force Base, TX: Air Force Human Resources Laboratory. (AD A014794).

Micheli, G.S. (1972). Analysis of the Transfer of Training, Substitution and Fidelity of Simulation of Training Equipment. (TAEG Report 2), Orlando, FL: Training Analysis and Evaluation Group, Naval Training Equipment Center.

Miller, G.G. and Rockway, M.R. (1975). New Concepts in Maintenance Trainers and Performance Aids. Maintenance Training in Advanced Instructional Systems," in W.J. King and J.S. Duva (Eds.), NAVTRAEQIPCEN IH-255, Orlando, FL: Naval Training Equipment Center.

Miller, Gary G. (1974). Some Considerations in the Design and Utilization of Simulators for Technical Training. (AFHRL-TR-74-65), Brooks Air Force Base, TX: Air Force Human Resources Laboratory, (AD A001630).

Miller, Gary G. and Gardner, Edward M. (1975). Advanced Simulator Performance Specification for an F-111 Test Station. (AFJRL-TR-75-70), Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Miller, Robert B. (1954). Psychological Considerations in the Design of Training Equipment. (WADC Technical Report 54-563), Wright-Patterson AFB, OH: Aero Medical Laboratory, Wright Air Development Center, (AD 71202).

Ministry of Education. (1984/September). Management for Educational Development in Sri Lanka.

Ministry of Education. (1984/August). Many Voices Many Needs--A Study of Tasks, Problems, Needs and Role Perceptions of Education Managers.

Ministry of Education. (1986/June). A Plan for the Development o: Facilities of the School System.

Ministry of Education. (1984). Report on Base-Line Survey on the Educational Needs of Non-School-Going Children Among Low-Income Groups in the City of Colombo. UNICEF.

Ministry of Education. (1985/September). Report on National Workshop on Coordinated Planning and Complementarily Between Formal and Non-Formal Education. UNESCO.

Ministry of Education. (1985). Report on Base-Line Survey on the Educational Needs of Non-School-Going Children in Three Assistant Government Agents' Divisions in the Anuradhapura District. UNICEF.

Mitchell, James E., CPT. (1987). Chief, Pilot Programs Branch, United States Army Ordance Missile Munitions Center and School Video Teletraining Experiment Case Study. Fort Eustis, VA: U.S. Army Training Support Center.

Modrick, John A.; Kanarick, Arnold F.; Daniels, Richard W. and Gardner, James A. (1975). New Concepts in Trainers and Performance Aids. (NAVTRAEQUIPCEN IH-255), "AEMT: technology issues in simulation for maintenance training," in King, W.J. and Duva, J.S. (Eds.), Orlando, FL: Naval Training Equipment Center.

Montemerlo, Melvin D. (1977). Training Device Design: The Simulation/Stimulation Controversy. (Technical Report NAVTRAEQUIPCEN IH-287), Orlando, FL: Naval Training Equipment Center.

Naresky, J.J. (1979). Avionics Reliability, Its Techniques and Related Disciplines. (AGARD Conference Proceedings No. 261), "A New Approach to Maintainability Production," in C. Jacobsen, (Ed.) Neuilly sur Seine, France: Advisory Group for Aerospace Research and Development.

Narragon, E.A.; Neil, J.M. and Wilk, J.R. (1978). Effectiveness of Army Direct and General Support Maintenance Units: Working Paper No. 2, Training of Military Mechanics. Washington, DC: Logistics Management Institute.

Nauta, F. and Bragg, L. (1980). Army Electronic Equipment Support Options: Assessment of Maintenance Complexity. (Working Note ML 904-2), Washington, DC: Logistic Management Institute.

Naval Training Equipment Center. (1978/July). Briefing Material on Maintenance Training Improvement Program.

Navy Personnel Research and Development Center. (1980/August), Improved Training in Operation of Steam Propulsion Plants. (Memorandum 01D:EMR:CCS).

Office of the Secretary of Defense. (1980). Aircraft Operating and Support Cost Development Guide. Washington, DC.

Olgren, Christine H. and Parker, Lorne A. (1983). Teleconferencing and Electronic Communications II: Applications, Technologies and Human Factors. (Volume II), Madison, Wisconsin: University of Wisconsin-Extension.

Orlansky, J. and String, J. (1981/August). Cost-Effectiveness of Maintenance Simulators for Military Training. (IDA Paper P-1568).

Orlansky, Jesse and String, Joseph. (1979). Cost-Effectiveness of Computer-Based Instruction in Military Training. (IDA Paper P-1375), Alexandria, VA: Institute for Defense Analyses, (AD A073 400).

Orlansky, Jesse and String, Joseph. (1981). Cost-Effectiveness of Maintenance Simulators for Military Training. (IDA Paper P-1568), Alexandria, VA: Institute for Defense Analyses, (AD A108 717).

Orlansky, J. and String, J. (1979). Cost-Effectiveness of Computer-Based Instruction in Military Training. (IDA Paper P-1375), Arlington, VA: Institute for Defense Analyses, (AD A073400).

Orlansky, J. and String, J. (1981). Performance of Maintenance Technicians on the Job. (IDA Paper P-1597), Arlington, VA: Institute for Defense Analysis.

Parker, E.L. and DePauli, J.F. (1967). The Development and Trial of a Generalized Sonar Maintenance Trainer. (NAVTRADEVCEN Technical Report 1757-1), Orlando, FL: Naval Training Device Center, (AD 381442).

Pieper, William J. and Benson, Philip G. (1975). Simulation Design Manual for the EC-II Simulator. (AFHRL-TR-75-14), Brooks Air Force Base, TX: Air Force Human Resources Laboratory,

Pine, S.M. and Koch, C.G. (1979). System Definition Analysis Technical Report for Electronic Equipment Maintenance Training System. (Honeywell Report F 2210-7), Minneapolis, MN: Honeywell, Inc., Systems and Research Center.

Platt, William A. (1976). An Evaluation of the EC-II at the Motor Transport School, Camp LeJeune, NC. Orlando, FL: Naval Training Equipment Center.

Plocher, T.A.; Miller, L.A.; Gardner, J.A. and Cronin, J.E. (1977). The Feasibility and Applications of a Computer-Based System for Electronic Test Equipment and Basic Electronics Training. Warminster, PA: Naval Air Development Center, Johnsville. (AD A039567).

Post, T.J. and Price, H.E. (1973). Development of Optimum Performance Aids for Troubleshooting. Falls Church, VA: Biotechnology, Inc.

Prophet, W.W. and Boyd, H.A. (1970). Device-Task Fidelity and Transfer of Training: Aircraft Cockpit Procedures Training. (Technical Report 70-10), Alexandria, VA: Human Resources Research Organization.

Purifoy, G.R. and Benson, E.W. (1979). Maintenance Training Simulators Design and Acquisition: Summary of Current Procedures. (AFHRL-TR-79-23), Lowry Air Force Base: Air Force Human Resources Laboratory.

Radsken, J.W. and Grosson, JF. (1975). 8th NTEC/Industry Conference Proceedings. "An Evaluation of Computer-Based Instruction for Performance of 'Hands-on' Training Evolutions," (pp. 221-226), Orlando, FL: Naval Training Equipment Center.

Randle, Capt. Robert M. (1980). Independent Evaluation Report of the Firefinder Training Device A17E 11 and A17E 12. (by USAFAS, TRADOC TRMS No. 80 OTN 435), Fort Sill, OK: U.S. Army Field Artillery School, (AD B054720L).

Redman, Carl. (1986/January). High-tech System Could Link Classrooms. State Times.

Reilly, R.E. (1977). Corporation Analysis of Part-Task Trainers for U.S. Army Helicopter Maintenance Training. (PM TRADE, 76-C-0098-1), Orlando, FL: U.S. Army Project Manager for Training Devices, Naval Training Equipment Center, (AD A037359).

Rifkin, K.I.; Pieper, W.J.; Folley, J.D. and Valverde, H.H. (1969), Learner-Centered Instruction (LCI): Volume IV-The Simulated Maintenance Task Environment (SMTE): A Job Specific Simulator. (AFHRL-TR-678-14), Brooks Air Force Base, TX: Air Force Human Resources Laboratory, (AD 855142).

Rigney, J.W.; Towne, D.M.; King, C.A. and Moran, P.J. (1978). Field Evaluation of the Generalized Maintenance Trainer-Simulator: I. Fleet Communications System. (Technical Report No. 89), Redondo Beach, CA: Behavioral Technology Laboratories, University of Southern California.

Rigney, J.W.; Towne, D.M.; Moran, P.J. and Mishler, R.A. (1980). Field Evaluation of the Generalized Maintenance Trainer-Simulator: II AN/SPA-66 Radar Repeater. (NPRDC TR 80-30), San Diego, CA: Navy Personnel Research and Development Center.

Roda, S.D. (1984). Literacy Programme for Out-of-School Children in Sri Lanka. (Report of Consultancy Mission), India, NCERT.

Rosenblum, Donald E. (1979). Combat Effective Training Management Study. Washington, DC: Office of the Assistant Secretary of Defense (MRA&L), The Pentagon, Room 3E808.

Rouse, W.B.; Rouse, S.H.; Hunt, R.M.; Johnson, W.B. and Pellegrino, S.J. (1980). Human Decision-Making in Computer-Aided Fault Diagnosis. (Technical Report 434), Alexandria, VA: Army Research Institute.

Rowan, T.C. (1973). Improving DoD Maintenance Through Better Performance Aids. Information Concepts, Inc., (AD 758713).

Savarise, Phil. (1987). Interview. The American Journal of Distance Education, Vol. 1, No. 3.

Seidel, RJ. and Wagner, H. (1977). Most-Effectiveness Specification for Computer-Based Training Systems. Alexandria, VA: Human Resources Research Organization.

Shaycoft, Marion F. (1979). Handbook of Criterion Referenced Testing Testing Development, Evaluation and Use. New York: Garland STPM Press.

Simpson, J.S. (1975). Basic Statistics. Hampden, Conn: Timet Books.

Slough, Dewey A. and Coady, J.D. (in preparation). Strategies for Computer Guidance of Oscilloscope Training. San Diego, CA: Navy Personnel Research and Development Center.

Spangenberg, Ronald W. (1974). Tryout of a General-Purpose Simulator in an Air National Guard Training Environment. (AFHRL-TR-74-92), Brooks AFB, TX: Air Force Human Resources Laboratory, (AD A009993).

Steele, G. (1983). The Hacker's Dictionary. New York: Harper & Row.

Steinemann, John H. (1966). Comparison of Performance on Analogous Simulated and Actual Troubleshooting Tasks. (Research Memorandum SRM 67-1), San Diego, CA: U.S. Naval Personnel Research Activity, (AD 636994).

String, J. and Orlansky, J. (1981). Evaluating the Effectiveness of Maintenance Training by Using Currently Available Maintenance Data. (IDA Paper P-1574), Arlington, VA: Institute for Defense Analyses.

String, Joseph and Orlansky, Jesse. (1977). Cost-Effectiveness of Flight Simulators for Military Training. (IDA Paper P-1275), Institute for Defense Analyses, Vol. II, Estimating Costs of Training in Simulators and Aircraft. Alexandria, VA: (AD A049 979).

Swanson, Robert A. (1954). The Relative Effectiveness of Training Aids for Use in Mobile Training Detachments. (Technical Report AFPTRC TR-54-1), Chanute AFB IL: Air Force Personnel and Training Research Center.

Swezey, Robert W. (1978). Comparative Evaluation of an Advanced Naval Engineering Maintenance Training Program. (NAVTRAEQUIPCEN 77-C-0150), Orlando, FL: Naval Training Equipment Center.

Task Order 601. (1986/April). Mandex Document. Analysis for School of the Air Interactive Video Training.

Taso, Alan. (1987). Video Teletraining Experiment Case Study. U.S. Army Quartermaster School, GS-11, School of the Air Data Analyst.

Torkelson, G.M. (1954). The Comparative Effectiveness of Mock-up, Cutaway and Projected Charts in Teaching Nomenclature and Function of the 40 mm Antiaircraft Weapon and the Mark 13 Type Torpedo. (Technical Report SPECDEVCEN 269-7-10), Port Washington, NY: Special Devices Center, Office of Naval Research, (AD 63936).

Towne, D.M. and Munro, A. (1981). Generalized Maintenance Trainer Simulator: Development of Hardware and Software. (NPROC TR 81-9), San Diego, CA: Navy Personnel Research and Development Center.

Townsend, Major Gene E. (1980/January). Air Force Magazine. "Air Force Maintenance--Issues and Challenges for the Eighties."

TRADOC Reg 350-4. (1985/June). TRADOC Training Effectivenes (TEA) System.

TRADOC Reg 350-7. (1985/April). Systems Approach to Training (SAT).

TRADOC Reg 350-15. (1983/August). TRADOC Training Evaluation, Standardization and Feedback Program.

TRADOC Reg 351-1. (1984/January). Training Requirements Analysis System (TRAS).

TRADOC Pam 71-8. (1976/February). Analyzing Training Effectiveness. TRADOC Pamplets.

Training Analysis and Development Directorate. An Evaluation of Trainer-Tester (Superheterodyne-Receiver). Gulfport, MS: DCS/O Headquarters Technical Training Air Force, (no date) (AD 99195).

Turke, J.G. (1977). Defense Management Journal. "It Isn't the Cost; It's the Upkeep," 13(3), 2-9.

University of Michigan Computing Center. (1986). Using the PC-Compatible as a UMnet Terminal: The Kermit-MS Program. Ann Arbor, Michigan: Microcomputer Support Group.

Valverde, H.H. (1968). Maintenance Training Media-An Annotated Bibliography. (AMRL-TR-67-151), Wright-Patterson Air Force Base, OH: Aerospace Medical Research Laboratories, (AD 673371).

Vorce, R. Management Plan for Generalized Maintenance Trainer/Simulator for Class "C" School Applications. (Project Z0108-PN.32), San Diego, CA: Naval Personnel Research and Development Center, (no date).

Vris, Thomas A. (1955). Comparison of Principles of Training and Specific Training Using Several Types of Training Devices. (Technical Report SDC 269-7 102), Port Washington, NY: Special Device Center, Office of Naval Research.

Vris, Thomas A. Trainer/Simulator for Class"C" School Applications. (Project Z0108-PN.32), San Diego, CA: Naval Personnel Research and Development Center, (no date).

Werthmann, Scott., (Publisher). (1988/Winter). CA-Insight. Garden City, NY: Computer Associates International, Inc.

Winer, B.J. (1962). Statistical Principles In Experimental Design. New York: McGraw-Hill, Inc.

Wohl, Joseph G. (1961). IRE Transactions on Human Factors in Electronics. "Why Design for Maintainability?" Vol. HFE-2,87-92.

Wohl, Joseph G. (1980). Diagnostic Behavior, System Complexity, and Repair Time: A Predictive Theory. (M80-00008), Bedford, MA: The Mitre Corporation,

Wright, J. and Campbell, J. (1975). Evaluation of the EC II Programmable Maintenance Simulator in T-2C Organizational Maintenance Training. (Report No. NADC-75083-40), Warminster, PA: Naval Air Development Center, Johnsville, (AD A012336).

Yates, Louise G. (1979). Status of Unit Training Within USAREUR Units. (Research Report 1207), Alexandria, VA: Army Research Institute.

Working Paper

WP LVN-88-1

MANPOWER, PERSONNEL AND TRAINING ANALYSIS
FOR THE STANDARDIZED INTEGRATED COMMAND POST SYSTEM (SICPS)

Rex R. Michel

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333

February 1988

MANPOWER, PERSONNEL AND TRAINING ANALYSIS FOR THE STANDARDIZED INTEGRATED COMMAND POST SYSTEM (SICPS)[1]

INTRODUCTION

The following Manpower, Personnel and Training (MPT) analysis concerns the preliminary design and fielding plan for the Standardized Integrated Command Post System (SICPS), light-wheel (HMMWV/CUCV) rigid-wall version. The light-wheel version was analyzed because the tent version is being procured under an accelerated program that precludes affecting its initial design while the heavy-wheel and tracked versions are not yet sufficiently defined to permit this type of analysis.

The analysis is preliminary at this stage. It is based upon existing requirements documents and discussions with project personnel from CACDA and the Natick and Fort Belvoir Research, Development and Engineering (RD&E) Centers. The design concepts were then compared with the force structures for the receiving units.

The result of this analysis is the identification of a number of MPT issues that will need to be addressed as the system design matures. The issues are discussed under each of the MPT subcategories.

DESCRIPTIONS OF RELEVANT SYSTEM ASPECTS

The light-wheel version is intended primarily for light forces where the HMMWV/CUCV are to be prime movers. The shelters will support combat, combat support, and combat service support C^3I operations at echelons from battalion through corps.

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[1]This MPT analysis was performed in the spring of 1987 and reported to the U.S. Army Human Engineering Laboratory for inclusion in their Human Factors Engineering Analysis. Also, the report was provided to the Combined Arms Combat Developments Activity (CACDA).

Operation of the shelter includes starting/stopping the power generators; adjusting the environmental controls; reading, operating and connecting/disconnecting the power and signal panel; adjusting the equipment racks; and removing and reinstalling the shelter on the primer mover. These tasks will be accomplished by personnel already assigned to command post staffs.

Maintenance tasks will be those required to maintain the power generator, environmental control system, power/signal distribution systems, and the basic shelter structure including the lifting jacks. Those MOSs identified for the maintenance of SICPS include 52C (Utilities Equipment Repairer), 52D (Power Generation Equipment Repairer), 63B (Light Wheeled Vehicle Mechanic), 63G (Fuel and Electric Repairer), 63W (Wheeled Vehicle Repairer), 63J (Quartermaster and Chemical Equipment Repairer), and 44B (Metal Worker).

MANPOWER ANALYSIS

Annex A contains tables showing the MOSs, ranks and number of enlisted personnel authorized for sixteen types of headquarters organizations (battalion through division) within the Light Infantry Division (LID), TO&E 77000L000. There are 119 MOSs represented within these headquarters organizations which is nearly one-third of the total MOSs within the Army structure. Clearly the SICPS is an MOS-immaterial system.[2]

As the light-wheel version of the SICPS is being designed for an operating crew of 3-4 there are no apparent operations manpower problems within these organizations. A potential manpower problem could exist in the removal/replacement of the shelter from its carrier for, say, a crew of three operating

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The current fielding plan would place twenty SICPS in a light infantry division: 12 in the division HHC, 4 in each maneuver brigade HHC, 4 in the Div Arty and 2 in the DISCOM HQ. However, SICPS is designed for use wherever Army Tactical Command and Control System (ATCCS) devices might be employed, down to battalion level. Thus it is conceivable that all of the headquarters listed in Annex A will eventually be SICPS equipped.

alone depending upon the final design of the lift jack system. Special attention needs to be given for the manpower requirements of tasks requiring performance by two or more operators simultaneously (e.g., lift requirements, running cables between shelters, and emplacement of separated components requiring simultaneous, coordinated actions). The design needs to be monitored to assure that a minimum crew can accomplish the tasks. In fact, the minimum number of personnel needed to operate the SICPS needs to be established, and addressed in terms of the other functions which have to performed by the crew.

Table 1 shows the number and location within the LID of the maintenance personnel identified as required for SICPS maintenance. There are two potential maintenance manpower problems raised by this analysis. The first is the lack of 44Bs (Metal Workers) available within the LID for structural repair. It seems reasonable to anticipate a great deal of structural damage to these shelters on the battlefield that might render them unusable without repair. The use as C^3I shelters will expose them to much indirect fire, and off-road use also increases the probability of structural damage. There are no 44Bs in the LID Maintenance Battalion (TOE 43045J800) and only one in the entire light division. It may be that the 63B and/or the 63W can handle the structural repairs but an analysis is recommended to estimate the task requirement and the skill and workload capacity of available maintenance personnel.

The second potential maintenance manpower problem concerns the power units and environmental control units with the shelters. To permit autonomous and dispersed operations, each shelter will have its own small power and environmental control units. Past command post configurations have used larger generators supplying power to multiple shelters or larger shelters. There may therefore, be at least a temporary increase in the number of power generator and environmental control units within the division due to the SICPS. The potential increase in workload and subsequent manpower requirements for the 52C and 52D MOSs must be kept in mind as RAM data for the proposed new units becomes available. Design/manpower tradeoffs may become necessary if the workload exceeds manning capabilities.

Table 1

Location , Type and Number of Maintenance Personnel Potentially Available for SICPS Maintenance, Light Infantry Division, TOE 77000L000

Organization	TO&E	44B	52C	52D	63B	63G	63J	63W	
Light Maint. Co., Maint. Bn.	43046J800			3	12		3		Division Level Support
Main Support Co., Maint. Bn.	43048J800		8	13		3	3	45	
HHC, LID	77004L000			1	4				
HHC, LID Bde (X3)	77042L000			3	45				
HHC, Inf Bn (X9)	07016L000				9				
HHC, CAB	01102L000			2	8				
HHC, Atk Hel Bn, CAB	01186L000			2	5				
HHT, Recon Sqdn, CAB	17186L000	1			13				Unit Mainte-nance
HHB, Div Arty	06102J400			2	4				
HHS Btry, FA Bn (X3)	06126J400			9	21				
HHB, ADA Bn	44116L000			1	4				
HHC, Engineer Bn	05156L000			1	5		1		
HHC, Signal Bn	11046L000			1	5				
MI Bn	34295L000		1	4	6				
HHC, Spt. Cmd., LID	63022J800			(None)					
HHC, Maint. Bn.	43046J800		1	2	14				
HHC, S&T Bn.	42026J800			1	12		4		
HHC, Medical Bn.	08046J800			4	12				

PERSONNEL ANALYSIS

There are no obvious high skill requirements for SICPS operators identified at this time. Starting, stopping and monitoring the power unit; adjusting the environmental control unit; adjusting the equipment racks; and removing/replacing the shelter on the prime mover should be tasks capable of performance by assigned MOS-immaterial personnel with some in-unit training. The design must be closely monitored, however, to be sure that complex operating procedures are not built into the equipment.

A potential exception to low skill operation is the connection of power and signal distribution. Operating requirements for the SICPS include the capability to distribute electrical power to adjacent SICPS and provide a cable management feature to allow data transfer and communications for the intra/inter SICPS equipment connectivity including Local Area Network. Care must be taken in the design to make these tasks sufficiently simple so that a variety of operators with little electrical/electronic knowledge can perform them satisfactorily with a few instructions and some unit-level hands-on training.

Again, there are, at this time, no obvious skill requirements for SICPS beyond the ability of the target maintenance audience. The use of commercial power generators, as in the SICPS, is becoming more common throughout the Army, and the 52D school at Fort Belvoir intends to prepare their students for this. The potential personnel problem with commercial power generation and environmental control equipment is the need for thorough and understandable maintenance documentation from the manufacturers as the maintenance personnel may not be exposed to the specific commercial items during institutional training.

TRAINING ANALYSIS

It is intended that all operator training will be conducted in the receiving units. This analysis concurs with the unit training concept for several reasons. First, as indicated in Annex A, there are 119 MOSs that could conceivably be involved in SICPS operations within the Light Infantry Division

alone. It would not be cost effective to add SICPS training to the institutional programs of that many MOSs. Secondly, only a small proportion of the soldiers within most of these MOSs would be assigned to headquarters units that use the SICPS; again making institutional training cost ineffective. And finally, the operations tasks do not appear sufficiently complex at this time to preclude unit-only training.

A good unit training package, however, is a necessity. That training package must minimize the amount of time involved for both unit trainers and trainees as additional training time is at a premium in most units. Also consideration needs to be given to identifying when non commissioned officers and officers are first introduced to the system.

Maintenance training on SICPS components is to be incorporated into the existing institutional training programs. For the Utilities Equipment Repairer (52C) and the Power Generation Equipment Repairer (52D) courses it appears at this time that they may use a more generic approach to training due to the large number of commercial power units being incorporated into the Army. Thus, instead of training on each type of unit, training may concentrate on the general characteristics and general maintenance tasks so that the maintainer can use the technical documentation available for the specific commercial items in use in the unit to which he/she is assigned. If this is actually done, SICPS will add very little to the institutional training requirements over the long run. However, until this is done it may be necessary to add some instruction on the SICPS power/environment control unit to the existing courses.

The Light Wheeled Vehicle Mechanic (63B), Fuel and Electric Equipment Repairer (63G), and Wheeled Vehicle Repairer (63W) courses might incorporate SICPS training into their HMMWV and CUCV training programs. At this time, the impact of SICPS on these programs appears minimal, but the final decision awaits analysis by the MOS proponents. Effects on the Quartermaster and Chemical Equipment Repairer (63J) and Metal Workshop (44B) courses also appear minimal but cannot be estimated at this time.

SUMMARY

The analysis raised the following MPT issues for consideration in developing and fielding the HMMWV/CUCV version of the SICPS.

a. Need to insure that a 3-soldier crew can remove/replace the shelter on the prime mover.

b. Need to insure that there will be sufficient crew available for tasks requiring simultaneous action by multiple soldiers or that equipment design precludes such tasks.

c. Lack of Metal Workers (44B) within the light forces at division level and below. The ability to meet the potential demand to repair structural damage to the SICPS needs to be investigated.

d. The ability of the currently authorized number of 52C and 52D maintainers to handle at least a temporary increase in the number of environmental control and power generators within the receiving units.

e. Need to assure that complex operating procedures are avoided in the SICPS design.

f. Need to assure that power and signal distribution coupling tasks can be done by operators with little or no electrical/electronic knowledge.

g. Need for thorough and understandable maintenance documentation on commercial items.

h. Need for an effective unit training package for operators that minimize the amount of unit training time required to become proficient in SICPS operations.

i. Need for maintenance MOS proponents to closely study the effects of SICPS on their instructional training programs.

ANNEX A

Distribution of Enlisted Personnel by Rank and MOS within the Headquarters Organizations of the Light Infantry Division (LID),

The following sixteen tables show the enlisted rank and MOS distribution for headquarters units at battalion and above within the LID, TOE 77000L000. Light forces from battalion through corps are scheduled to receive the light wheeled (HMMWV/CUCV) rigid-walled version of the SICPS. These tables give the manpower footprint through division level of potential operators of the SICPS.

Table A-1

HHC, Light Infantry Division. TOE 77004L000 (Strength Level 1)[1]

	11B	31C	31V	52D	54E	63B	64C	71C	71D	71E	71L	71M	71Q	71R	72E	75B	75C	75D
E-3	4	1				1			1		1				3		2	
E-4		1	1	1		1		4	1		12	1	1	1	4		2	1
E-5		1				1	2	4	1	1	3				1	1	2	1
E-6	7				2	1	1	1		1							1	
E-7	4				2				1		1	1						
E-8	3								1		1							
E-9	1																	
Totals	19	3	1	1	4	4	3	9	5	2	18	2	1	1	8	1	7	2

	75E	76C	76Y	91A	91B	94B	96B	96D	96R	97B	97G	98C	98G	Totals
E-3				2		5	1							21
E-4	2		1	2		6	3					1		46
E-5	1	1			1	2	4			1	1	2	1	32
E-6			1			2	2							19
E-7						1		1	1	2				14 (15)[2]
E-8								1	1			1		8 (13)[2]
E-9														1 (7)[2]
Totals	3	1	2	4	1	16	10	2	2	3	1	4	1	141 (153)[2]

1 Strength level 2 drops to 139 and strength level 3 to 121 (including first sergeants).
2 Includes first sergeants with MOS designator "Z".

Table A-2

HHC, Light Infantry Division Brigade. TOE 77042L000 (Strength Level 1)[1]

	11B	31C	31K	31V	36C	36M	52D	54E	63B	71D	71L	71M	75B	76C	76Y	94B	96B	Totals
E-3	2	1	2						5		1		1			10	1	23
E-4	2		1	1	1	2	1		4		2		1		2	13	1	31
E-5			1						4		1	1	1	1		4	1	14
E-6	1								1						1	7	2	12
E-7	2							1	1	1						3		8 (9)[2]
E-8	2			1												1		4 (5)[2]
E-9	1																	1 (2)[2]
Totals	10	1	4	2	1	2	1	1	15	1	4	1	3	1	3	38	5	93 (96)[2]

1 Strength level 2 totals drop to 76 and strength level 3 to 67 (including first sergeants).
2 Includes first sergeants with MOS designators "Z".

Table A-3

HHC Infantry Bn, Light Infantry Division. TOE 07016L000[1]

	11B	31K	31V	54E	63B	71D	71L	71M	75B	76Y	77F	91A	91B	96B	Totals
E-3	12	3	5						2	3	1				26
E-4	5	3				1	1	1	1	2		14			28
E-5	2	2	1		1				1	1		3	5	1	17
E-6	1			1					1	1			1		5
E-7	2		1							1			1		5 (6)[2]
E-8	3														3
E-9															(1)[2]
Totals	25	8	7	1	1	1	1	1	5	8	1	17	7	1	84 (86)[2]

1 Figures do not include the Scout Platoon, Mortar Platoon, or Anti Armor Platoon.
2 Includes first sergeants with MOS designator "Z".

Table A-4

HHC, Combat Aviation Brigade, Light Infantry Division. TOE 01102L000 (Strength Level 1)[1]

	31C	31K	31V	36M	52D	54B	55B	63B	66V	67V	75B	76C	76Y	77F	91A	91B	93P
E-3	1				1		11	2		2		2	2	14	1		4
E-4		1	1	1			8	2		2		1	2	14	1		2
E-5		2		1	1		5	2		1	1		1	14		1	1
E-6							1	1	1	2			1	1			1
E-7						1		1						1			1
E-8																	
E-9																	1
Totals	1	3	1	2	2	1	25	8	1	7	1	3	6	44	2	1	10

	94B	96B	Totals
E-3	3		43
E-4	3	1	39
E-5	2	1	33
E-6	2	2	12
E-7	1		5
E-8			(3)[2]
E-9			1 (2)[2]
Totals	11	4	133 (137)[2]

1 Strength level 2 total drops to 124, strength level 3 to 115 (including first sergeants).
2 Includes first sergeants with MOS designator "Z".

Table A-5

HQ & S Co, Attack Helicopter Bn, CAB, Light Infantry Division. TOE 01186L100 (Strength Level 1)[1]

	31C	31G	31V	35K	52D	54B	63B	66J	66N	66V	66Y	67N	67V	67Y	68B	68D	68F	68G
E-3			1	4	1		2					2	3	5				1
E-4	1			2		1	1					2	2	4	1	1	1	1
E-5			1	2	1		1			1	2	2		2	1	1		1
E-6						1		1	1	1	2			1				
E-7		1					1							2				
E-8																		
E-9																		
Totals	1	1	2	8	2	2	5	1	1	2	4	6	5	14	2	2	1	3

	68J	68K	68M	71D	75B	76C	76Y	91A	91B	93P	96B	Totals
E-3	3		3		1	3	2	1		1		33
E-4	2		2	1	1	3	2	1		1	1	31
E-5	2		2			1	1		1		2	24
E-6	1				1		1					10
E-7		1					1			1		7 (8)[2]
E-8										1		1 (2)[2]
E-9												(1)2
Totals	8	1	7	1	3	7	7	2	1	4	3	106 (109)

1 Strength level 2 totals drop to 98 and strength level 3 to 92 (including first sergeants).
2 Includes first sergeants with MOS designator "Z".

Table A-6

HHT, Reconnaissance Squadron, Light Infantry Division. TOE 17186L000[1] (Strength Level)[2]

	19D	31C	31V	44B	54E	63B	66J	66N	66V	66Y	67Y	71D	71L	71M	75B	76C	76Y	91A
E-3	3	3				4										2	1	2
E-4	1	2	3	1		2						1	1	1	1		2	6
E-5	1	1				3			1	1					2	1	1	
E-6					1	2	1	1	1	1							1	
E-7			1			1					1						1	
E-8						1												
E-9																		
Totals	5	6	4	1	1	13	1	1	2	2	1	1	1	1	3	3	6	8

	91B	93P	94B	96B	Totals
E-3			3		18
E-4		1	3		25
E-5	2		1	2	16
E-6	1		1		10
E-7		1	1		6 (7)[3]
E-8					1 (3)[3]
E-9					(2)[3]
Totals	3	2	9	2	76 (81)[3]

1 Figures here do not include the CEWI Flight Platoon.
2 Strength level 2 totals drop to 74 and strength level 3 to 67 (including first sergeants).
3 Includes first sergeants with MOS designator "Z".

Table A-7

HHB, Division Artillery, Light Infantry Division. TOE 06102J400 (Strength Level 1)[1]

	13B	13C	13E	13F	13W	13Y	31C	31K	31V	52D	54E	63B	71D	71L	71M	72E	75B	76C
E-3	2						4	2	1	1		1		2		1		
E-4			5				4			1		1		2		1	2	1
E-5							4					1			2	2	1	
E-6			1	2			1											
E-7		1		1					1		1	1	1					
E-8					1	2												
E-9																		
Totals	2	1	6	3	1	2	13	2	2	2	1	4	1	4	2	4	3	1

	76Y	82C	91A	91B	93F	96B	Totals
E-3		1	1		2		18
E-4	1	10	1		3	1	33
E-5		5		1	1	1	18
E-6	1	2			1	1	9
E-7	1	1			1		9 (10)[2]
E-8							3
E-9							(1)[2]
Totals	3	19	2	1	8	3	90 (92)[2]

1 Strength level 2 total drops to 89, strength level 3 to 80.
2 Includes first sergents with MOS designator "Z".

Table A-8

HHS Battery, Field Artillery Battalion[1], Light Infantry Division. TOE 06126J400 (Strength Level 1)[2]

	13B	13C	13E	13F	13Y	13W	17B	17C	26C	31C	31K	31V	52D	54E	63B	71D	71L	75B
E-3	3		1	13				1		1	1	6	1		2			2
E-4			4	13					1	1			2		3	1	2	1
E-5			1	27			3			1	1				1			1
E-6			1	9			1							1				
E-7	1	1		4			1					1			1			
E-8					2	1												
E-9																		
Totals	4	1	7	66	2	1	5	1	1	3	2	7	3	1	7	1	2	4

	76C	76W	76Y	82C	91A	91B	94B	96B	Totals
E-3		1	2	2	1		2		38
E-4	1		2	4	4		2		41
E-5			1	2		1	2		42
E-6			1	2			1	1	17
E-7			1	1			1		12 (13)[3]
E-8									3
E-9									(1)[3]
Totals	1	1	7	11	5	1	8	1	153 (155)[3]

1 Three such battalions of 105mm, towed howitzers are contained in the divisional artillery brigade.
2 At strength level 2 the total drops to 152 and at strength level 3 to 143 (including first sergeants).
3 Includes first sergeants with MOS designator "Z".

Table A-9

HHB, ADA Bn, SHORAD, Light Infantry Division. TOE 44116L000 (Strength Level)[1]

	16H	31V	52D	54E	63B	71D	71L	75B	76C	76Y	77F	96B	Totals
E-3		2	1		1			2			1		6
E-4	11				1	1	1	1		1			17
E-5	4			1	1			2	1	1			9
E-6	3				1			1		1		1	6
E-7	4	1								1			6 (7)[2]
E-8													(4)[2]
E-9													(1)[2]
Totals	22	3	1	1	4	1	1	6	1	4	1	1	46 (52)[2]

1 At strength level 2, total drops to 51 and strength level 3 to 49 (including first sergeant).
2 Includes first sergeants with MOS designator "Z".

Table A-10

Military Intelligence Battalion, Light Infantry Division. TOEs 34-296L000, 297L000 & 298L000[1]
(Strength Level 1)[2]

	11B	11C	12B	29E	29J	29S	31C	31K	31V	31Y	33T	39C	52C	52D	54B	63B	71D	71L
E-3							6	3	1		2			2		2		
E-4				1	1	1	6				4	1	1			2	1	2
E-5				1		1	5	3	1		1			2	3	1		
E-6	2	1	1				3				1							
E-7										1	1				1	1		
E-8																		
E-9																		
Totals	2	1	1	2	1	2	20	6	2	1	9	1	1	4	4	6	1	2

	72E	75B	76C	76Y	96B	96D	96J	96R	97B	97E	97G	98C	98G	98J	Totals
E-3	1	1	1	1	1			8	1		2	5			35
E-4	2	1		4	1			16	5	10	2	8	38	1	108
E-5	2		2		1	1		8	5	5	2	13	16	1	74
E-6		1		3	1	1	1	5	7	4	1	2		1	36
E-7				1				1	1	2			4		14 (15)[3]
E-8					1			1							2
E-9															(1)[3]
Totals	5	3	3	9	5	2	1	39	19	21	7	28	58	3	269 (274)[3]

1 Includes the HQ & HQ & Service Company, the Collection Company, and the Intelligence & Surveillance Company. Totals do not include the LRS Detachment.
2 At strength level 2 the total drops to 246 and at strength level 3 to 213 (including first sergeants).
3 Includes first sergeants with MOS designator "Z".

Table A-11

HHC, Engineer Battalion, Light Infantry Division. TOE 05156L000 (Strength Level 1)[1]

	12B	31G	31K	31V	52D	54B	62B	62E	62J	62N	63B	63J	63S	71D	71L	75B	76C	76Y
E-3	6			1			5	5	8		2					1		1
E-4	1		1		1		4	9	8		1	1	1	1	2	2		2
E-5				1			4	4	8		1						1	1
E-6	1						1			2	1					1		1
E-7		1				1				1								1
E-8																		
E-9																		
Totals	8	1	1	2	1	1	14	18	24	3	5	1	1	1	2	4	1	6

	81B	91A	91B	96B	Totals
E-3					29
E-4	2	6			42
E-5				1	21
E-6			1		8
E-7					4 (5)[2]
E-8					(5)[2]
E-9					(1)[2]
Totals	2	6	1	1	104 (111)[2]

1 Strength level 2 total drops to 110 and strength level 3 to 109 (including first sergeants).
2 Includes first sergeants with MOS designator "Z".

Table A-12

HHC, Signal Battalion, Light Infantry Division. TOE 11046L000 (Strength Level 1)[1]

	29E	29J	29M	29N	29W	31K	31N	31V	36M	52D	54E	63B	71D	71L	72E	75B	76C
E-3			1	2		1			1	1		1			1	1	
E-4	1	3	1	1				1	1			1	1	2	3	1	
E-5	1		1	1					1			1			1		1
E-6							2								1		
E-7					1						1	1					
E-8												1					
E-9																	
Totals	2	3	3	4	1	1	2	1	3	1	1	5	1	2	6	2	1

	76Y	77F	96B	Totals
E-3	2	1		12
E-4	2	1		19
E-5			1	8
E-6	1			4
E-7	1			4 (7)[2]
E-8				1 (4)[2]
E-9				(1)[2]
Totals	6	2	1	48 (55)[2]

1 Strength level 2 total drops to 51 and strength level 3 to 49 (including first sergeant).
2 Includes first sergeants with MOS designator "Z".

Table A-13

HHC, Support Command, Light Infantry Division. TOE 63022J800 (Strength Level 1)[1]

	31C	31S	31V	54E	55B	55R	63H	64C	71C	71D	71L	71M	71N	72E	74F	75B	76Y
E-3													1				
E-4	4					1		1	1		8	1	1	1		2	2
E-5	1					1					2	1		1			1
E-6		1				1					1				1		1
E-7				1	3		3			1			1	1			1
E-8			1														
E-9																	
Totals	5	1	1	1	3	3	3	1	1	1	11	2	3	3	1	2	5

	94B	96B	Totals
E-3	1		2
E-4	1		23
E-5	1	1	9
E-6			5
E-7	1		12 (13)[2]
E-8		1	2 (10)[2]
E-9	1		1 (3)[2]
Totals	5	2	54 (65)[2]

1 Strength level 2 totals drop to 63 and strength level 3 to 54.
2 Includes first sergeants with MOS designator "Z".

Table A-14

HQ, Maintenance Bn, Support Command, Light Infantry Division. TOE 43046J800[1]

	27B	31C	31V	52C	52D	54E	62B	63B	63H	63S	64C	71D	71L	75B	76C	76P
E-3		1	1		1			5		4					1	
E-4		1		1	1		1	4		1	2	1	3	2	1	
E-5			1					3		1						
E-6								1								
E-7	1					2	1	1	2							1
E-8																
E-9																
Totals	1	2	2	1	2	2	2	14	2	6	2	1	3	2	2	1

	76Y	96B	Totals
E-3	1		14
E-4	1		19
E-5			5
E-6			1
E-7	1	1	10 (13)[2]
E-8			(1)[2]
E-9			(1)[2]
Totals	3	1	49 (54)

1 Does not include figures for the Light Maintenance Company which is also part of this TOE.
2 Includes first sergeants with MOS designator "Z".

Table A-15

HQ & Spt Co, S&T Bn, Support Command, Light Infantry Division. TOE 42026L000 (Strength Level 1)[1]

	31C	31G	31K	31V	52D	54B	57F	62B	63B	63J	63S	71D	71L	75B	76C	76P	76V	76Y
E-3	1								3	2				1			6	1
E-4			1	1	1			1	4	1	1	1		1		1	3	2
E-5			1						3	1	1		1	1	1		3	
E-6									1					1			1	1
E-7		1				1	1		1								1	1
E-8																		
E-9																		
Totals	1	1	2	1	1	1	1	1	12	4	2	1	1	4	1	1	14	5

	76X	77F	77W	88M	94B	96B	Totals
E-3	4	6	3	3	3		33
E-4	2	2	6	5	4		37
E-5	1		3		1	1	18
E-6			1		1		6
E-7		1			1		8 (9)[2]
E-8							(3)[2]
E-9							(1)[2]
Totals	7	9	13	8	10	1	102 (107)

1 Strength level 2 total drops to 104 and strength level 3 to 98 (including first sergeants).
2 Includes first sergeants with MOS designator "Z".

Table A-16

HQ Medical Bn, Support Command, Light Infantry Division. TOE 08046L000[1] (Strength Level 1)[2]

	31C	31G	31K	35U	42E	52D	54B	63B	71D	71G	71L	75B	76C	76J	76Y	91A	91B	91G
E-3	1					2		3		1		1	1	1	1	1		1
E-4	1		1			1		4	1	1	1	1	1	1	1			2
E-5	1			1	1	1		3				1						2
E-6		1		1				1				1						1
E-7							1	1						1	1		2	1
E-8																	2	
E-9																		
Totals	3	1	1	2	1	4	1	12	1	2	1	4	2	3	3	1	4	7

	91Q	91S	91Y	Totals
E-3		2		15
E-4		3	1	20
E-5		1		11
E-6	1			5
E-7		1		9 (10)[3]
E-8				2
E-9				(1)[3]
Totals	1	7	1	62 (64)[3]

1 Does not include figures for A Company which is also part of this TOE.
2 Strength level 2 totals drop to 54 and strength level 3 to 45 (including first sergeants).
3 Includes first sergeants with MOS designator "Z".

WORKING PAPER

WP LVN-90-02

WORKSPACE ASSESSMENT OF A BATTALION TASK FORCE COMMAND POST

Rex R. Michel
Jon J. Fallesen

March 1990

Reviewed by: JON J. FALLESEN
Leader,Staff Operations Team

Approved by: STANLEY M. HALPIN
Chief, Fort Leavenworth Field Unit

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

WORKSPACE ASSESSMENT OF A BATTALION TASK FORCE COMMAND POST

BACKGROUND

The Director of the Combined Arms Combat Development Activity, Command and Control Directorate requested that ARI assess the workspace designs of selected Standardized Command Post configurations. Several designs have been assessed and comments provided back to their respective designers. One design feature that has been a focus of several discussions is a difference in arrangement of vehicles and common working areas between the Battalion Task Force and Brigade concepts. This report documents the findings of observing the operation of the Battalion Task Force command post concept.

The Infantry School developed the command post configuration shown in Figure 1 for adoption as the Standardized Command Post for Armor and Mechanized Infantry Battalion Task Forces Army-wide. The Task Force design uses a different arrangement of vehicles and common working area than the corresponding Brigade command post shown in Figure 2. To determine the impact of the Battalion Task Force layout on performance, a representation of the Task Force configuration was assessed at the SIMNET facility at Fort Knox. The Task Force configuration was used in two Pre-Command Course (PCC) exercises by PCC students and Fort Knox cadre on 23 February 1990. An ARI observer was present to observe information flow among staff elements and personnel traffic within the workspace layout. Link analysis was used to assess the nature of movement and interaction among staff elements. This report briefly describes the approach and findings of the assessment.

METHOD

The purpose of the assessment was to **see if any inefficiencies in performance would be observed that could be ascribed to the workspace.** To do this, command post communication and personnel traffic were observed and recorded.

A technique from industrial engineering called link analysis was used to assess the workspace. Link analysis is based on the theory that the best arrangement of personnel and equipment can be determined by optimizing the links between elements in the system being designed. The rationale behind link analysis is that layouts can be optimized by minimizing distances or times for important and frequent interchanges. Our primary consideration was frequency of exchanges among key staff personnel. Distance and frequency of movement were other factors observed.

Staff interaction data were collected and compiled into a

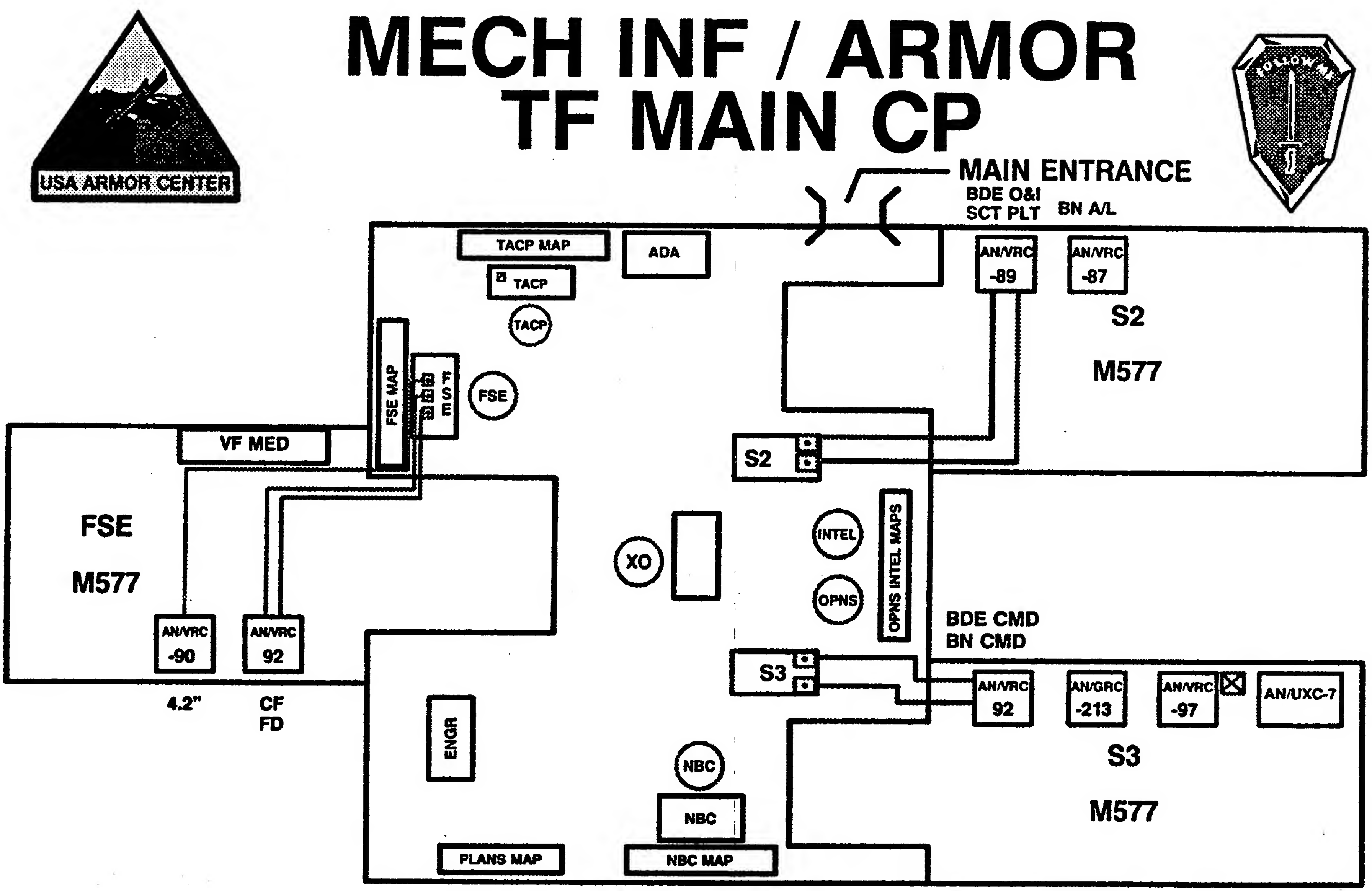

Figure 1. Task Force Main Command Post layout.

AR/MECH BRIGADE MAIN CP

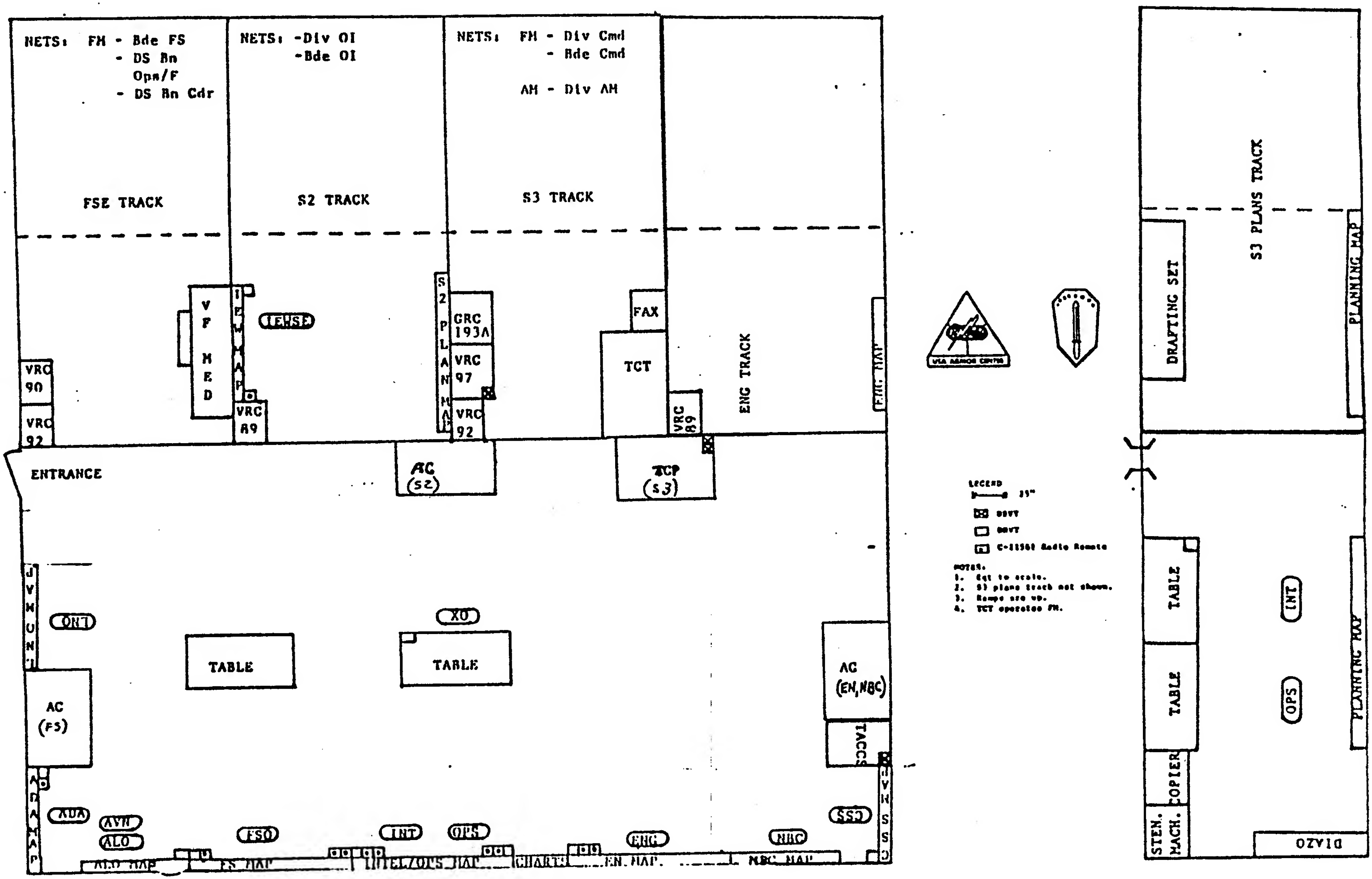

Figure 2. Mechanized Infantry Armor Brigade Main Command Post (25 Jan 90).

sender-receiver matrix (for example see Table 1). Each interaction between different staff elements was counted. The essence of the interaction was also recorded. Only interactions between elements were recorded; interactions within a staff element (e.g. fire support or operations) were not recorded. Frequencies of communications with elements external to the command post also were not recorded, although the use of the radio sets typically were captured in the movement analysis. Only interactions pertaining to the portrayal of command post actions were recorded; exercise control and other extraneous conversations were not counted.

Movement data were recorded on a plan view diagram of the command post layout. Movements of the players were traced onto the diagram. A new, unmarked copy of the diagram was used about every ten minutes of exercise play. The movements were later transcribed onto one diagram to show the quantity of traffic among command post locations.

There were several atypical features due to the training environment.

1. There were some changes to the layout design as depicted in Figure 3. The most obvious change was Brigade and Battalion command post nets were located at work tables on either side of the NBC map area, rather than at the S3 worktable as indicated in Figure 1.

2. The M577 ramps were not present in the SIMNET mock-ups, providing more spacious working and traffic areas.

3. There were two executive officers (XOs) in each command post exercise. These were played by four different students from the Armor School PCC. Between each pair they decided what they would do. In exercise 1, the pair participated in the decision making together and were usually side-by-side. In exercise 2, one XO was clearly the leader and performed typical XO duties. He stationed himself near the battalion command net. The second XO was fairly inactive and was located next to the operations-intelligence map.

4. There was no air defense or chemical personnel representation in either exercise.

Other characteristics of the exercises included the following.

1. Both exercises were fought using SIMNET over ground within the Fort Knox area. The mission consisted of an Armored Task Force defending against a Soviet-type motorized rifle regiment. The operation was purely

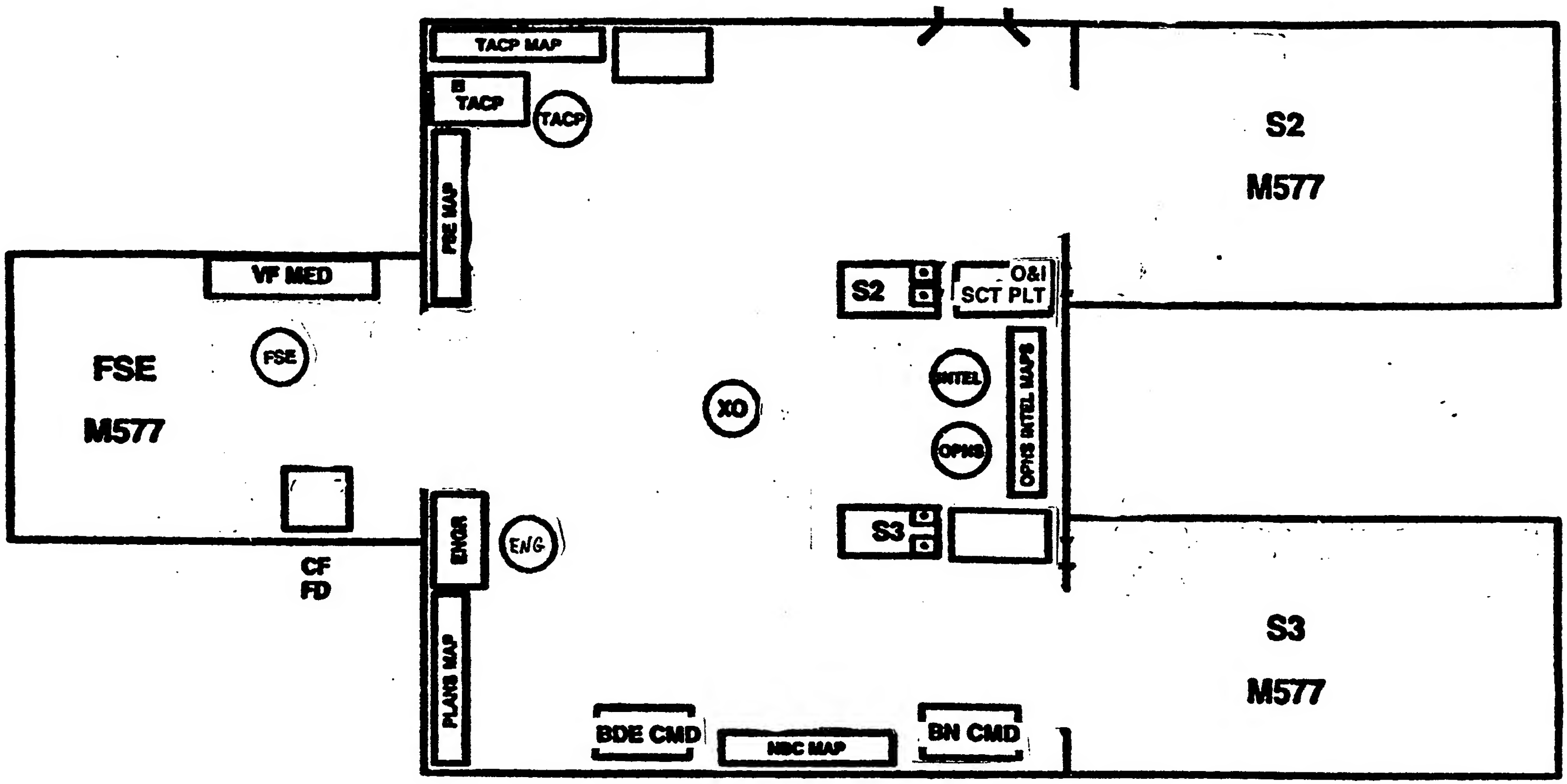

Figure 3. Modified Task Force Command Post for SIMNET.

execution and did not involve any planning for future operations.

2. A Commander and an S3 were deployed on the simulated battlefield, operating from simulated Armored vehicles. They were in communication with the command post via the Battalion command net. Company and Platoon participants also were actually present in simulated Armored vehicles.

3. Division and Brigade control cells were present.

4. A Macintosh computer was used in the fire support element M577 to simulate the functions of the Variable Function Message Device (VFMED) of TACFIRE.

5. Commercial citizens band radios were used to emulate tactical radio nets.

There were 14 personnel participating as Battalion staff in each exercise. Some of the key personnel came from the PCC students, the rest from Fort Knox cadre. The personnel manned the following positions.

Officers

Executive officer-1 (XO-1)
Executive officer-2 (XO-2)
S2
Assistant S3 (Asst S3)
Fire support officer (FSO)
Engineer officer (Eng)

Enlisted

S2 Sergeant (S2 NCO)
Operations and intelligence plotter (OI)
Brigade command net radio telephone operator (Bde RTO)
Battalion command net RTO (Bn RTO)
Battalion O&I net RTO (O&I RTO)
Field artillery Sergeant-1 (FA-1)
Field artillery Sergeant-2 (FA-2)
USAF Sergeant-air liaison (TACP)

The staff elements within the command post were the XO, operations, intelligence, fire support, engineer, and tactical air control party (TACP). These were used as the elements in the link analysis.

RESULTS

Tables 1 and 2 show the frequency of interactions among staff elements. The rows represent the initiating sender of the interaction, and the columns represent the receiver of the interaction. The numerical entries show the number of interchanges between the initiating and receiving staff elements. For example in the first exercise, the S2 initiated interaction with the assistant S3 5 times in the two hour exercise. The S2 initiated interaction with the assistant S3 2 times in the second exercise which was observed for one and a half hours.

Table 1.
Frequency of interaction among staff elements in Exercise 1.

				RECEIVER			
INITIATOR	XO	Asst S3	S2	FSE	Eng	TACP	TOTALS
XO		2	18	3	4	6	33
Asst S3	5		1	0	1	1	8
S2	3	5		3	0	0	11
FSE	1	0	0		1	0	2
Eng	1	2	4	0		0	7
TACP	4	0	0	1	0		5
TOTALS	14	9	23	7	6	7	66

Table 2.
Frequency of interaction among staff elements in Exercise 2.

				RECEIVER			
INITIATOR	XO	Asst S3	S2	FSE	Eng	TACP	TOTALS
XO		5	16	9	0	0	32
Asst S3	8		5	6	0	0	19
S2	15	2		2	0	0	19
FSE	9	1	2		0	0	12
Eng	0	0	0	0		0	0
TACP	5	0	1	0	0		6
TOTALS	37	8	24	17	0	2	88

Table 3 shows the overall frequency of interactions among staff element pairs for which there were at least six or more interactions for the two exercises combined. These data show

that the most frequent interaction was between the XO and the S2. The four most frequent interactions pairings all involved the XO. Three out of every four interactions involved the XO.

Table 3.
Frequency of interaction between pairs of staff elements.

PAIR	FREQUENCY
XO - S2	52
XO - FSE	22
XO - Asst S3	20
XO - ALE	17
S2 - Asst S3	13
S2 - FSE	7
FSE - Asst S3	7

Results of the movement analysis for the first exercise are illustrated in Figure 4. Both XOs who were coequal generally stood in the center but with considerable movement to the battalion command net radio to talk with the Battalion Commander. In this arrangement they were able to interact with the S2 and Asst S3 without movement.

In the second exercise, the active and dominant XO spent most of his time at the battalion command net and the general flow of traffic was toward him at that position (see Figure 5). In both exercises there was considerable traffic between the operations and intelligence area and the brigade command net radio. The movement was required to update the Brigade on the Task Force situation and for the brigade net RTO to gather information from the XO or operations-intelligence area that had been requested by Brigade.

In both exercises movements to and from the FSE M577 were to pass targets and to gather targeting information, some of which were very time critical. Having the FSE remain in their M577 caused obvious problems in movement and appeared to delay the passage and coordination of short-lived target opportunities. The air force liaison (TACP) movements were also for targeting and to pass battle damage battle assessments.

The XO did not orchestrate coordination with FSE and TACP from a central, stationary point in the command post as planned in the design. In both exercises the XO moved to the staff element or radio that he needed to interact or relied on the FSE and TACP to move towards him for coordination. With the XO near the battalion command net for most of Exercise 2, the TACP had to move the maximal distance across the common work area and the FSE had to move out of the M577 to interact.

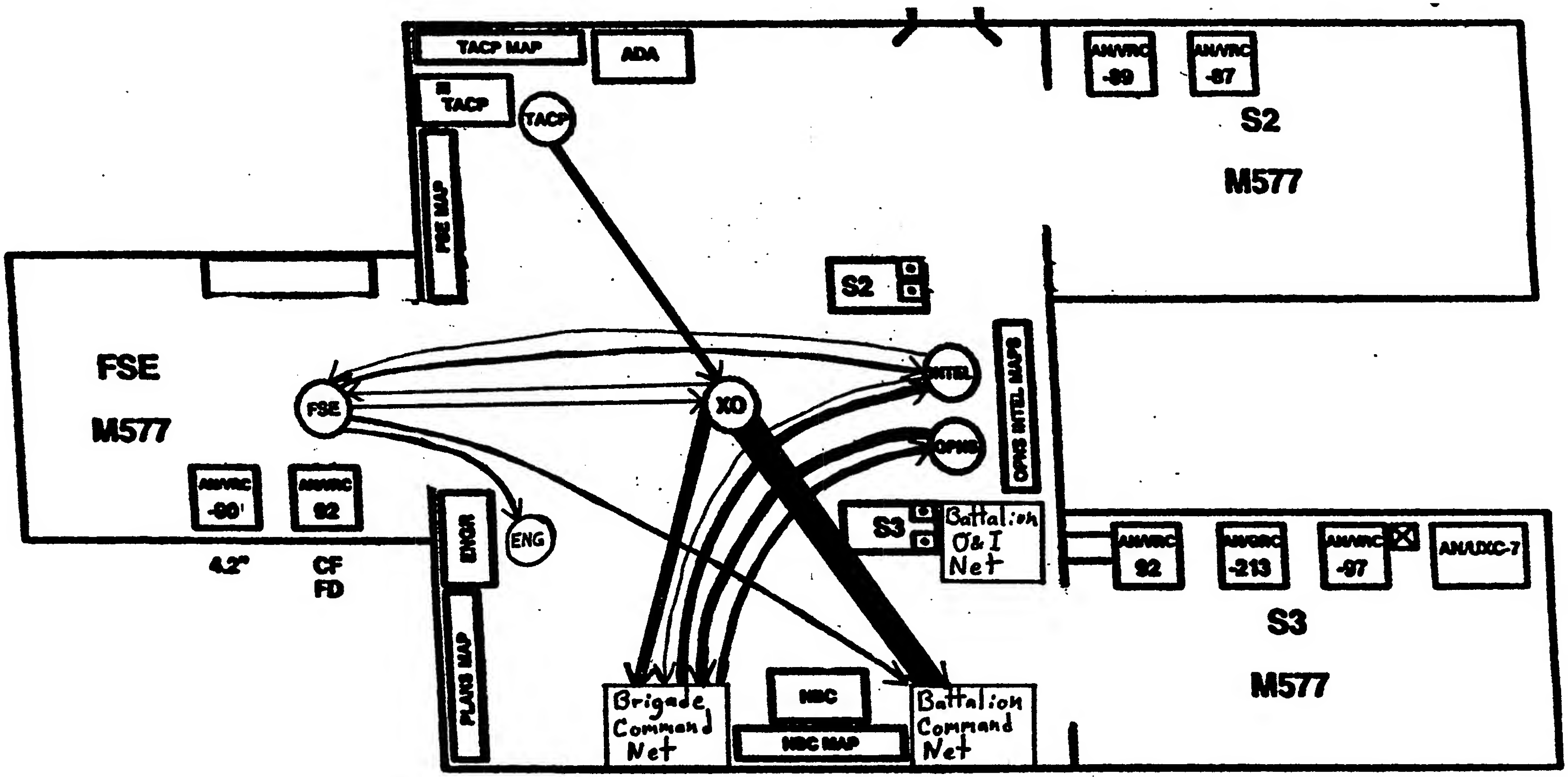

Figure 4. Player movement patterns, exercise one.

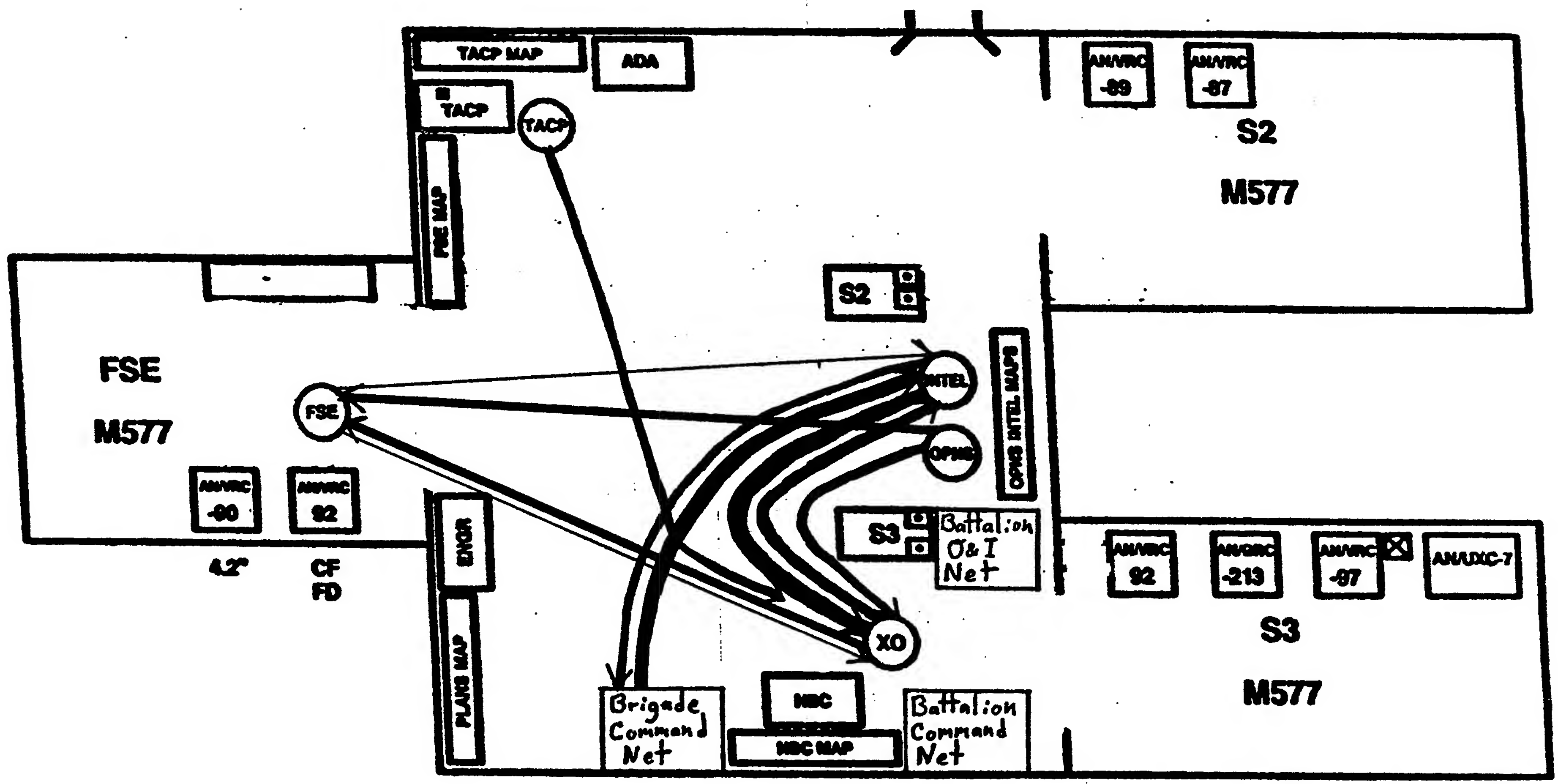

Figure 5. Player movement patterns, exercise two.

CONCLUSIONS

Several of the features of command post operation in these training exercises were not typical of Task Force operations as pointed out above. Nevertheless several aspects of the configuration can be addressed with confidence. The following conclusions are presented based on the observations made during actual use of the workspace.

1. Having the S2 and Asst S3 side-by-side sharing the same map and having the XO also located in that immediate area would be an obvious advantage in keeping key staff members current on the situation.

2. The brigade and battalion command nets should be placed within reach of this grouping (as indicated in the Infantry School concept depicted in Figure 1). This provides the key communications near the XO and the operations and intelligence area.

3. Further improvements are expected by locating FSE and TACP representatives in the immediate vicinity with the XO, S2, and Asst S3. Cutting down movement and travel distance are desirable goals for critical and efficient communications.

Since the Infantry School concept (Figure 1) for arrangement of M577s does not offer enough room in the operations-intelligence area to locate additional personnel, it is recommended that a three side-by-side arrangement be tested similarly to the assessment reported here.

1 October 1987

WP LVN-87-1

PD 8814

WORKING PAPER

DESIGN DOCUMENT:
Preliminary Requirements for EDDIC

The Experimental Development, Demonstration, and Integration Center

Bruce J. Packard and Paul E. McKeown
Science Applications International Corporation

Jon J.Fallesen, Robert Solick, and Stanley M. Halpin
US Army Research Institute

U.S. Army Research Institute
for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria VA 22333-5600

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FORWARD

This document is an ARI Working Paper intended for limited distribution. The document describes the preliminary design of the Experimental Development, Demonstration, and Integration Center (EDDIC) being developed by the Fort Leavenworth Field Unit of the US Army Research Institute. The development of EDDIC is being supported by the Los Alamos National Laboratory; preparation of this Design Document was accomplished under Contract Number 9-X5E-9825E-1 for the Los Alamos National Laboratory by Science Applications International Corporation, 424 Delaware, Suite C3, Leavenworth, Kansas, 66048.

It is anticipated that the EDDIC design will evolve as the laboratory facility undergoes successive stages of implementation and utilization. This Design Document will be expanded and modified to reflect those evolutionary changes. Comments, suggestions, or questions are welcome, and should be directed to:

Dr. Fallesen, Mr. Solick, or Dr. Halpin
ARI Field Unit
PO Box 3407
Fort Leavenworth, Kansas 66027-0347.

Telephone: 913/684-4933
or Autovon 552-4933
ARPAnet: LVNWORTH@ARI-HQ1.ARPA.

or to:

Mr. Bruce Packard or Mr. Paul McKeown
Science Applications International Corporation
424 Delaware, Suite C3
Leavenworth, Kansas 66048

Telephone: 913/651-7925
ARPAnet: MCKEOWN@ARI-HQ1.ARPA

1. REQUIREMENT

The Fort Leavenworth Field Unit of the Army Research Institute is tasked with a three part mission to improve the operational effectiveness of Army command groups and staffs. The mission includes the improvement of command group training and instruction, development of methods to assess the performance of command and control (C2) staffs, and the enhancement of staff performance through improved procedures or tools. The mission is executed through behavioral research and prototype development efforts, and is conducted by in-house researchers and technical support contractors.

During several years of research conducted concurrently with command staff exercises it became apparent that a dedicated research facility was required to allow a capability to control experimental events. In the past, experiments were performed in the context of computer supported simulations, such as the Army Training Battle Simulation System (ARTBASS). Although this approach allowed effective use of existing resources, it did not allow sufficient control over the independent and dependent variables of interest. When the need was recognized a prototype laboratory consisting of a workstation with multiple displays and input devices was developed and tried out to determine the feasibility of the concept. The concept was demonstrated to be an appropriate means to obtain staff performance data on a course of action option planning study.

A multi-year plan was developed to build, implement and utilize a division-level C2 human performance laboratory, referred to as the Experimental, Development, Demonstration and Integraion Center (EDDIC). A major portion of the effort involves a support contract to develop and integrate hardware and software, to develop human performance enhancement aids and evaluate their use by a staff, and to develop and evaluate tactical staff training modules. This document provides the first description of the EDDIC functional software design requirements and can be used in similar software requirements definition efforts. Detailed functional requirements include narrative descriptions of the requirements, data flow diagrams, and process specifications. The description is by no means complete and is continuing to be developed and refined. Areas requiring further definition are indicated as "to be supplied" or "to be determined".

1.1 COMPUTER PROGRAM DEFINITION

This document describes the functional software design of the Experimental Development Demonstration and Integration Center (EDDIC). EDDIC shall emulate a division tactical Command Post (CP) with initial emphasis on the operations and intelligence staff elements. This shall be accomplished through the use of scenarios and databases that reflect normal division staff functions and tasks. Experiments shall be under experimenter control and accommodate either single or multiple subjects.

EDDIC shall be hosted on high-resolution color workstations connected by a Local Area Network (LAN). Program development shall be performed using the Ada programming language to the extent possible. The workstation displays shall be window-based with each window corresponding to specific functions performed by the subject. The windowing function shall be implemented using X windows standard protocol for network transparent windowing. The following windows shall be provided in EDDIC:

- Technical Reference - Display technical reference material such as TO&E data and equipment characteristics. Only static data is displayed in this window. Reference products can be textual reports, graphs, or map overlays.

- Tactical Situation - Display the tactical situation for both the current situation and the situation history. Unit locations, statuses and other battlefield situation data are examples of situation products. Tactical situation products can be textual reports, graphs, or map overlays.

- Message - Display and process message traffic to a experiment participant. Message processing options will include view, save, drop, scan saved messages, and scan message log. Messages can be textual forms or map overlays.

- Build - Command and control products are built in this window and routed to other experiment participants or to the database. When a product is routed to the database, it becomes an entry in the tactical situation products and can be viewed in the tactical situation window. The command and control products can be textual forms or map overlays.

- Tool - Contains tools and aids that do not require direct access to tactical situation data. These tools could include such things as notepads, spreadsheets, and other off-line aids.

- Experiment Control - Display of experiment guidance information to the experiment participants. This window will also display forms that will require the participant to fill in the blanks and send the results back to the experiment control process.

The windows described above shall provide the basis for the Soldier Machine Interface (SMI) for the initial EDDIC capabilities. Detail descriptions of the windows and the SMI is provided in section 1.3. All interactions with the windows shall be recorded for post-experiment replay and analysis. Task aids, decision aids, and training modules shall be integrated into the existing windows to provide a common interface with the subject. Enhancements can be made to the SMI but must be integrated into the existing windowing system.

The software functional design described in section 1.2 provides for easy integration of task aids, decision aids, and training simulations into EDDIC. The design also allows enhancing the SMI with an intelligent interface that will provide enhanced control of the subjects display based on knowledge of the current tactical situation, the subject's tasks, and the subject's preference for display of information.

1.2 DETAILED FUNCTIONAL REQUIREMENTS

Figure 1.2-1 is the data flow diagram of EDDIC. This chart shows each of the major processes of EDDIC and the data which must flow between these processes as well as the external data required. Data flow diagrams show only the flow of data between processes which transform that data in some way. They do not represent any sequence of processes or cause and effect relationship. Commands are not considered to be data and are therefore not shown except in cases where they appear as data to a process that passes the command to other processes.

The major processes of EDDIC are shown in Figure 1.2-1 and are explained in the following sections:

- Define Experiment - Experimenter interacts with the system to define the type of experiment to be performed and to define and modify the experiment database (Section 1.2.1).

- Perform Experiment - An experiment (or demonstration) is performed using the experiment database as defined by Define Experiment. (Section 1.2.2).

- Analyze Experiment - Use the experiment log and the experiment database to produce selected reports and displays that analyze the experiment (Section 1.2.3)

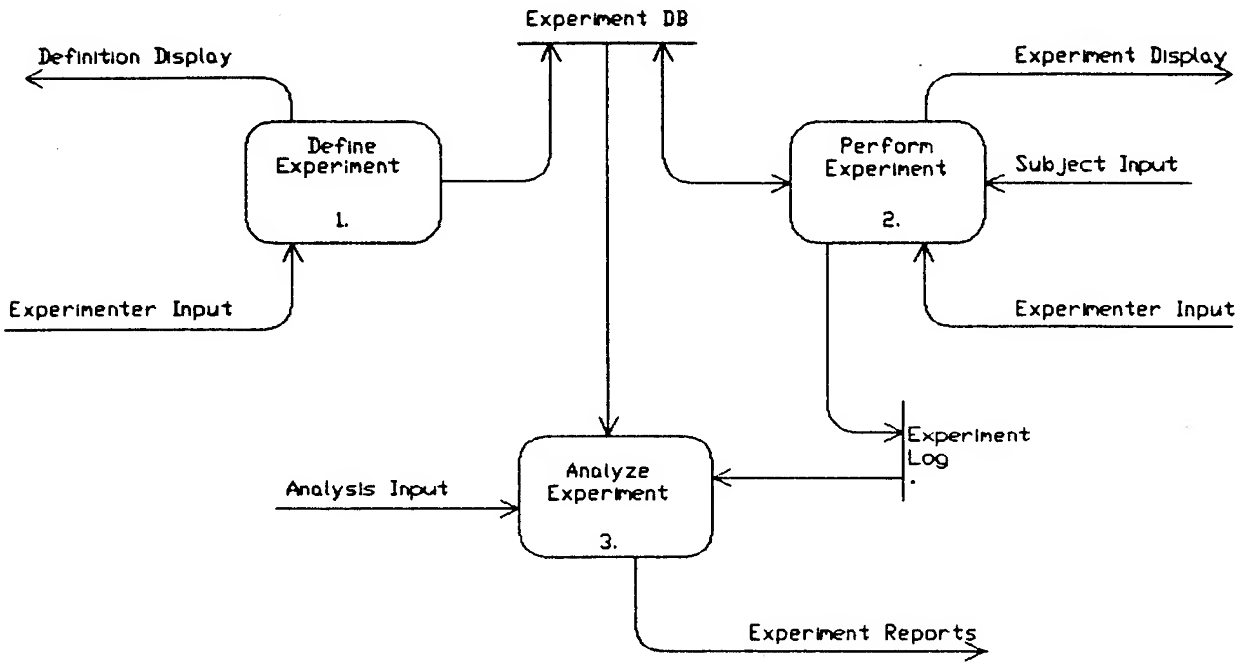


Figure. 1.2-1 EDDIC DATAFLOW

1.2.1 Define Experiment

(TO BE SUPPLIED)

1.2.2 Perform Experiment

The process shall be started by initializing each workstation in the mode required to support the experiment. The experimenter's workstation must be initialized first to allow all the workstations in the network to see the configuration of the experiment and to start up file server processes.

The Perform Experiment process consists of those subordinate processes shown in Figure 1.2.2-1; Control Experiment, Maintain Tactical Situation, Perform C2 Functions, and Record Experiment.

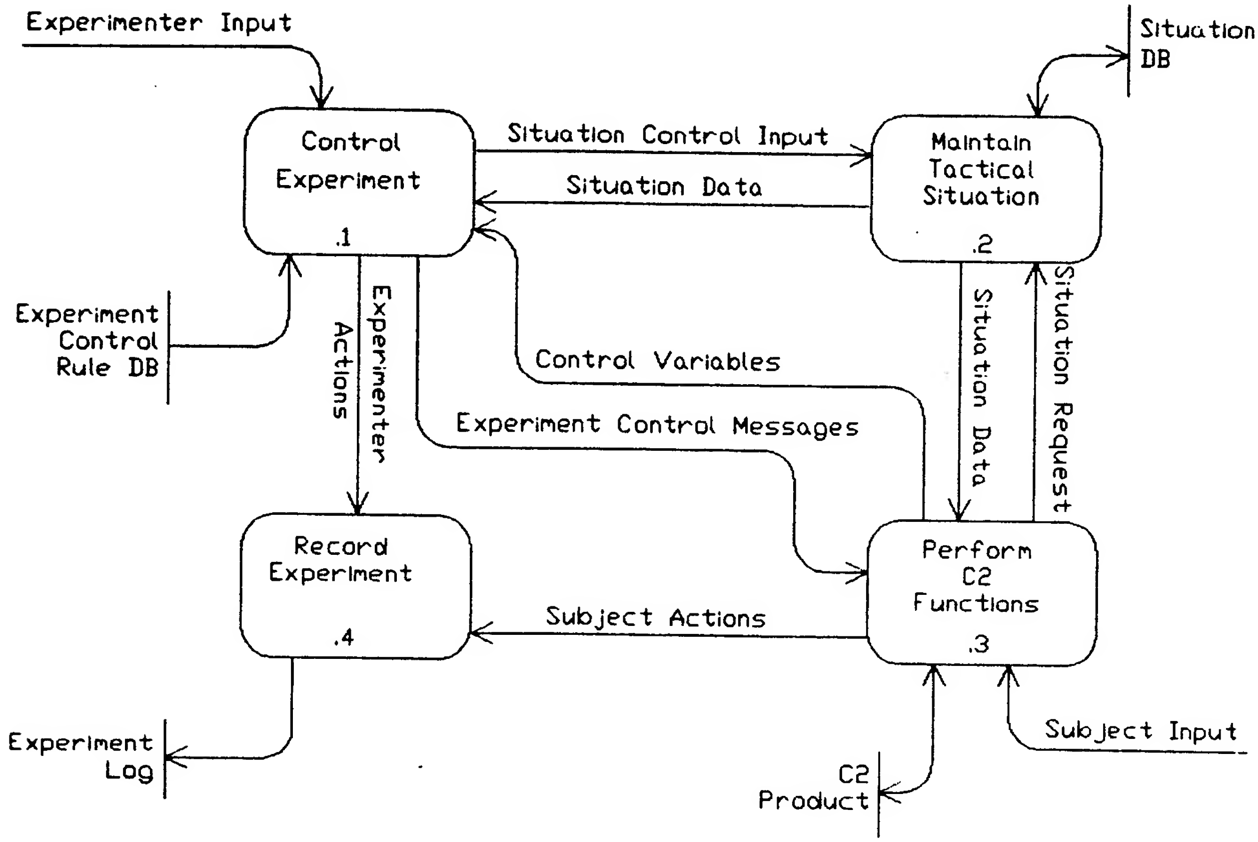


Figure 1.2.2-1 PERFORM EXPERIMENT

1.2.2.1 Control Experiment

This process shall interact with the experimenter and control the flow of an experiment. The experimenter can update the tactical situation through this process and can also send experiment control messages to the participant's experiment control window. Experimenter actions are recorded for experiment analysis purposes.

In the initial design, this process will be very unsophisticated and will probably only display an initial introduction message. With the enhancements from task 3 and 4, this process may contain a rule base that will control the flow of an experiment and analyze participant input and provide feedback in the participants experiment control window.

The process specification for the process Control Experiment follow:

PROCESS NAME: CONTROL_SITUATION

PROCESS NUMBER: 2.1

```
DATA FLOW AND I/O USE:
   I     CONTROL_VARIABLES
   I     EXPERIMENT_CONTROL_RULE_DB
   I     EXPERIMENT_INPUT
   I     SITUATION_DATA

   O     EXPERIMENTER_ACTIONS
   O     EXPERIMENT_CONTROL_MESSAGES
   O     SITUATION_CONTROL_INPUT

SPECIFICATION:
   loop until EXPERIMENT_COMPLETE
      accept EXPERIMENTER_INPUT
      if CONTROL_MESSAGE
         format EXPERIMENT_CONTROL_MESSAGE
         send EXPERIMENT_CONTROL_MESSAGE to SUBJECT
      else if SITUATION_UPDATE
         request SITUATION_DATA from MAINTAIN_TACTICAL_SITUATION
         update SITUATION_DATA
         send SITUATION_CONTROL_INPUT to
              MAINTAIN_TACTICAL_SITUATION
      end if
   end loop

NOTES:
```

1.2.2.2 Maintain Tactical Situation.

This process shall maintain the master situation database and shall receive updates and requests for data from the Control Experiment and Perform C2 Functions processes. The tactical situation data includes unit descriptions, control measure definitions and other battlefield situation data for both the current and past tactical situation.

The process specification for the process Maintain Tactical Situation follows:

```
PROCESS NAME: MAINTAIN_TACTICAL_SITUATION

PROCESS NUMBER: 2.2

DATA FLOW AND I/O USE:
   I     SITUATION_CONTROL_INPUT
   I     SITUATION_REQUEST

   O     SITUATION_DATA

   IO    SITUATION_DB

SPECIFICATION:
   loop until EXPERIMENT_COMPLETE
```

```
      accept TACTICAL_TRANSACTION
      if DATA_RETRIEVAL
         read SITUATION_DATA from SITUATION_DB
         send SITUATION_DATA to REQUESTOR
      else if DATA_UPDATE
         read SITUATION_DATA from SITUATION_DB
         update SITUATION_DATA
         write SITUATION_DATA to SITUATION_DB
      end if
   end loop
```

NOTES:

1.2.2.3 Perform C2 Functions

This process is responsible for maintaining the subject's displays. It provides a user friendly interface that allows the subject to view products and reports, use tools and aids to help him in his assigned task and produce and transmit products that he has been assigned to complete.

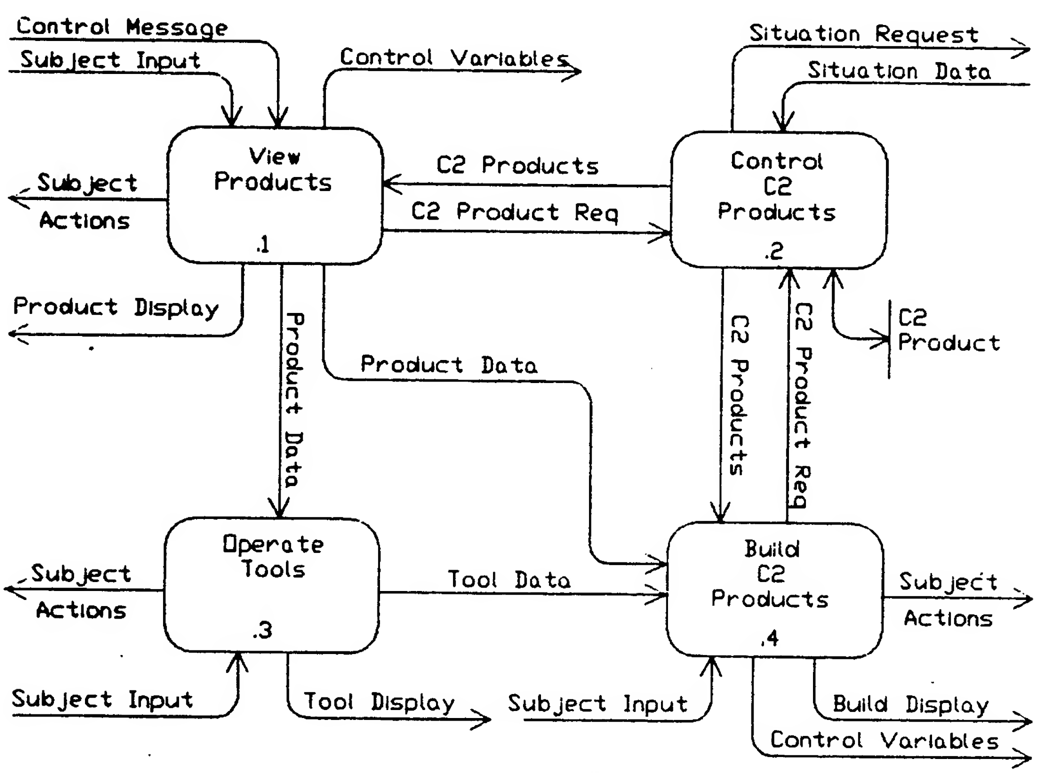


Figure 1.2.2.3-1 PERFORM C2 FUNCTIONS

The Perform C2 Functions process consists of those subordinate

processes shown in Figure 1.2.2.3-1; View Products, Control C2 Products, Operate Tools, and Build C2 Products.

1.2.2.3.1 View Products

This process controls the windows that allow the experiment participants to view reports and products. The reports and products include technical reference data, tactical situation data, messages, and experiment control messages.

The View Products process consists of those subordinate processes shown in Figure 1.2.2.3-2; View Technical Reference, View Experiment Control, View C2 Situation, and View Message.

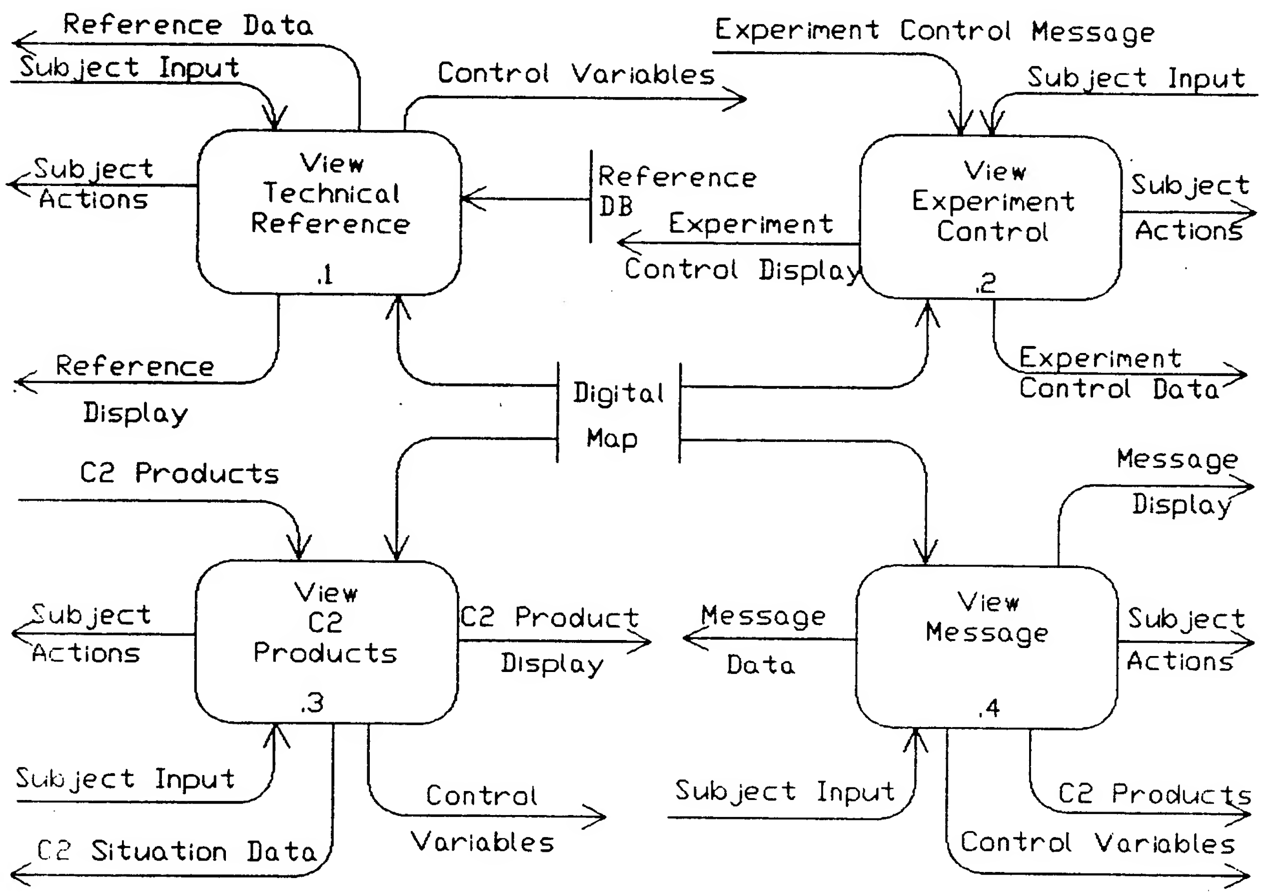


Figure 1.2.2.3-2 VIEW PRODUCTS

1.2.2.3.1.1 View Technical Reference. This process controls the window that allows the experiment participant to view static reference products. These products can be textual reports, graphs, or map overlays. Technical reference data consist of information that normally would be found in a manual or book. It does not contain any tactical situation data.

The View Technical Reference process consists of those subordinate processes shown in Figure 1.2.2.3-3; Manage Reference Display, Aid Reference Viewing, Display Reference Overlays, and Manage Intelligent Interface.

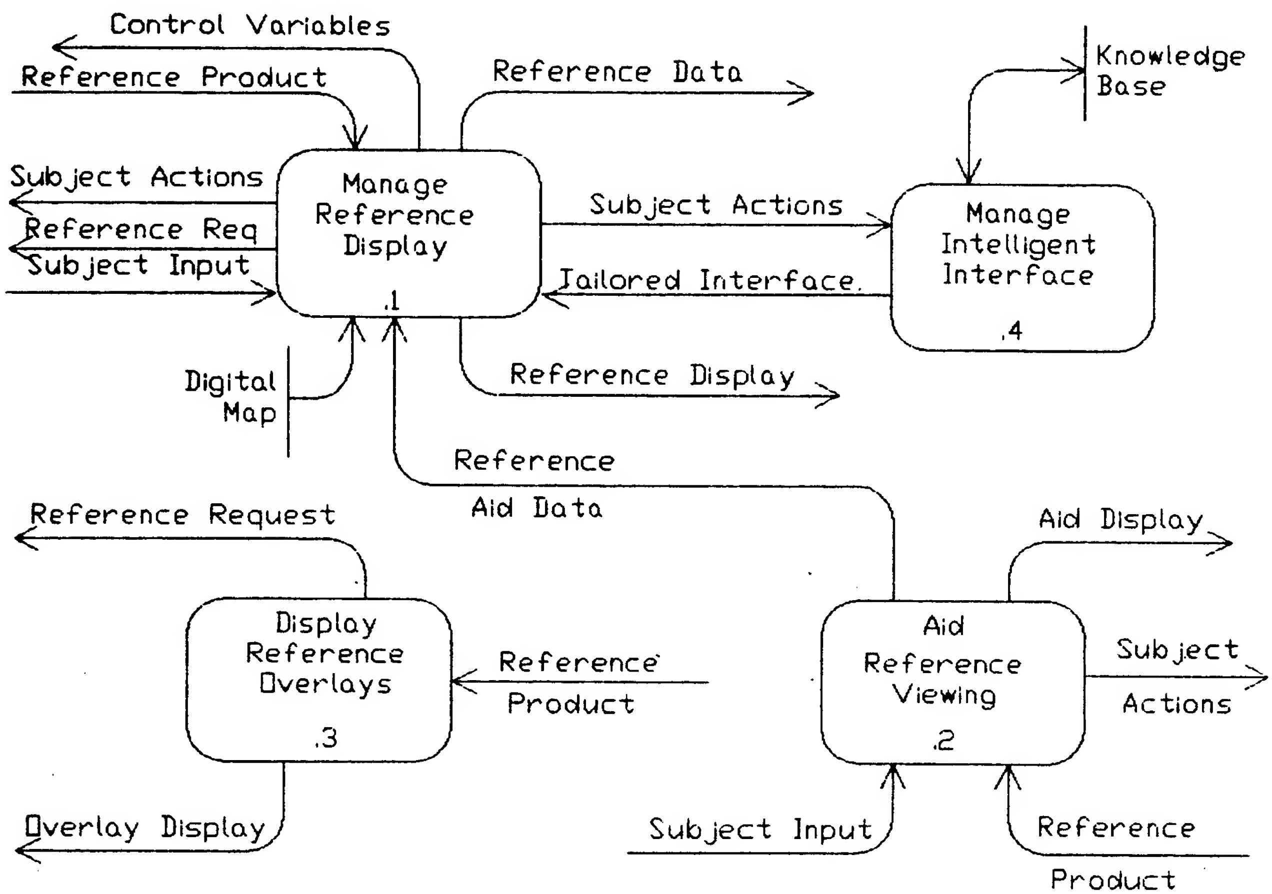


Figure 1.2.2.3-3 VIEW TECHNICAL REFERENCE

1.2.2.3.1.1.1 Manage Reference Display. This process handles all user interactions with the view reference display. The main interaction with the user is to display the walking menu to allow selection of the desired reference product and to display the selected product. This process also must determine when to use a reference aid, whether to display a product as a textual report, graph, or map overlay and must interface with the intelligent interface software.

The process specification for the process Manage Reference Display follows:

PROCESS NAME: MANAGE_REFERENCE_DISPLAY

PROCESS NUMBER: 2.3.1.1.1

DATA FLOW AND I/O USE:

```
I      DIGITAL_MAP
I      REFERENCE_AID_DATA
I      REFERENCE_PRODUCT
I      SUBJECT_INPUT
I      TAILORED_INTERFACE

O      CONTROL_VARIABLES
O      REFERENCE_DATA
O      REFERENCE_DISPLAY
O      REFERENCE_REQ
O      SUBJECT_ACTIONS
```

SPECIFICATION:

```
loop until WINDOW_ELIMINATED
   accept REPORT_SELECTION
   read PRODUCT from REFERENCE_DB
   if TEXTUAL_REPORT
      display TEXTUAL_REPORT
   else if GRAPH
      display GRAPH
   else if MAP_OVERLAY
      do DISPLAY_REFERENCE_OVERLAYS
   end if
end loop
```

NOTES:

1.2.2.3.1.1.2 Aid Reference Viewing. This process includes any modules that are added to the View Technical Reference process and aid the user in viewing a technical reference product.

The process specification for the process Aid Reference Viewing follows:

PROCESS NAME: AID_REFERENCE_VIEWING

PROCESS NUMBER: 2.3.1.1.2

DATA FLOW AND I/O USE:

```
I      REFERENCE_PRODUCT
I      SUBJECT_INPUT

O      AID_DISPLAY
O      REFERENCE_AID_DATA
O      SUBJECT_ACTIONS
```

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.1.3 Display Reference Overlays. This process displays the map overlay reference products. It also displays the digital map and handles all the map control interactions. Multiple reference products may be displayed simultaneously on the map.

The process specification for the process Display Reference Overlays follows:

PROCESS NAME: DISPLAY_REFERENCE_OVERLAYS

PROCESS NUMBER: 2.3.1.1.3

DATA FLOW AND I/O USE:

```
I     REFERENCE_PRODUCT

O     OVERLAY_DISPLAY
O     REFERENCE_REQUEST
```

SPECIFICATION:

```
if DIGITAL_MAP_DISPLAYED
   add PRODUCT to OVERLAY_DISPLAY
else
   display DIGITAL_MAP
   display PRODUCT
end if
```

NOTES:

1.2.2.3.1.1.4 Manage Intelligent Interface. This process shall customize the user interface depending upon the contents of the knowledge base.

The process specification for the process Manage Intelligent Interface follows:

PROCESS NAME: MANAGE_INTELLIGENT_INTERFACE

PROCESS NUMBER: 2.3.1.1.4

DATA FLOW AND I/O USE:

```
I     SUBJECT_ACTIONS

O     TAILORED_INTERFACE

IO    KNOWLEDGE_BASE
```

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.2 View Experiment Control. This process controls the window that allows the presentation of experiment control information to the participant. It also prompts the participant for data and passes the data back to the experiment control process. This process is created by the experiment control process instead of by the participant.

The View Experiment Control process consists of those subordinate processes shown in Figure 1.2.2.3-4; Manager Control Display, Aid Control Display, Display Control Overlays, and Manage Intelligent Interface.

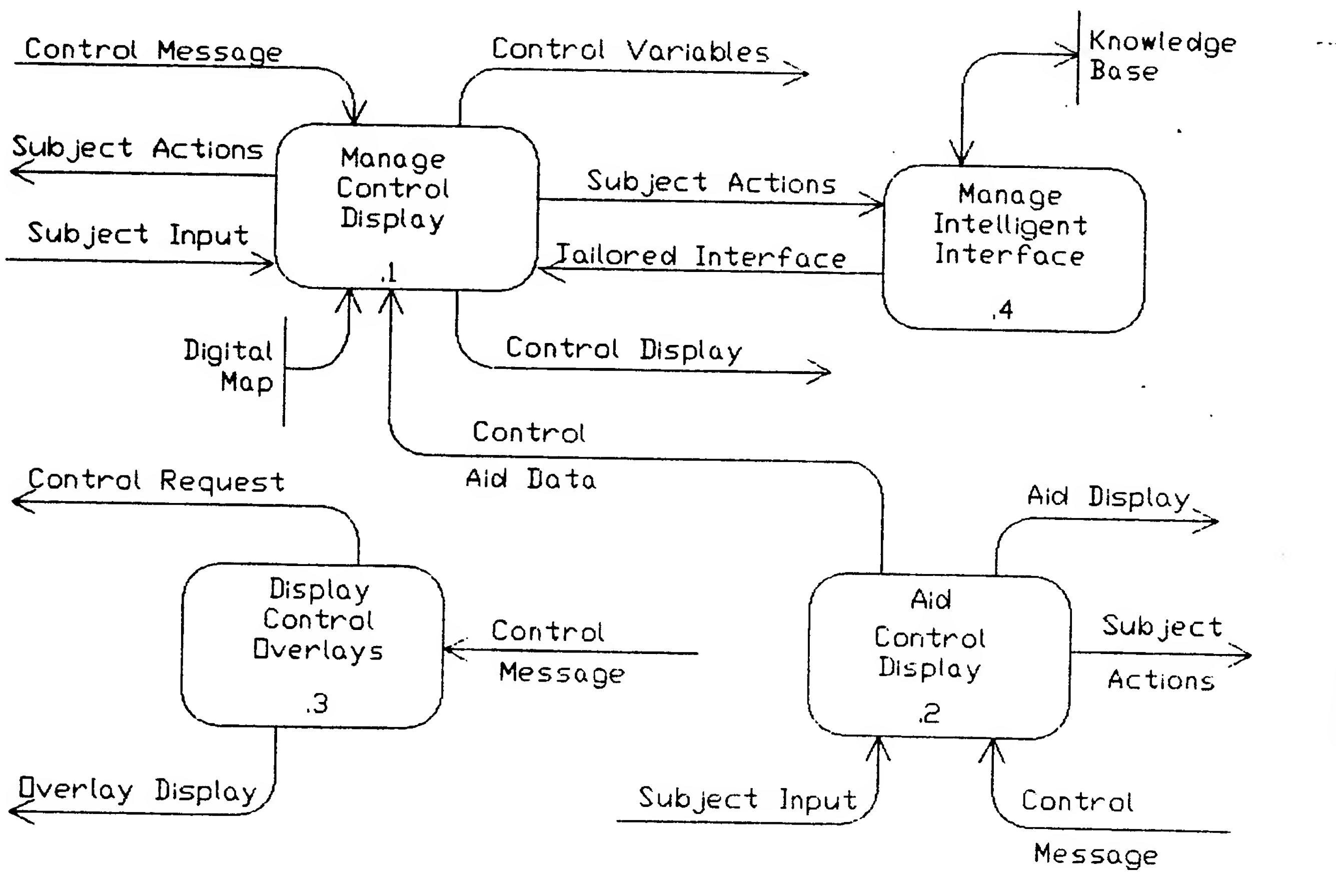


Figure 1.2.2.3-4 VIEW EXPERIMENT CONTROL

1.2.2.3.1.2.1 Manage Control Display. This process handles all user interactions with the view experiment control display. The main interaction with the user is to display the experiment message or form and to accept the participant form input. This process also must determine when to use a control aid, whether to display a

message as a textual report, form, or map overlay and must interface with the intelligent interface software.

The process specification for the process Manage Control Display follows:

PROCESS NAME: MANAGE_CONTROL_DISPLAY

PROCESS NUMBER: 2.3.1.2.1

DATA FLOW AND I/O USE:

```
   I      DIGITAL_MAP
   I      CONTROL_AID_DATA
   I      CONTROL_MESSAGE
   I      SUBJECT_INPUT
   I      TAILORED_INTERFACE

   O      CONTROL_VARIABLES
   O      CONTROL_DISPLAY
   O      SUBJECT_ACTIONS
```

SPECIFICATION:

```
   if CONTROL_MESSAGE
      display CONTROL_MESSAGE
   else if CONTROL_FORM
      display CONTROL_FORM
   else if CONTROL_MAP_OVERLAY
      do DISPLAY_CONTROL_OVERLAYS
   end if
   loop until WINDOW_ELIMINATED
      if CONTROL_FORM
         accept FORM_INPUT
      end if
   end loop
   if CONTROL_FORM
      send CONTROL_FORM to CONTROL_EXPERIMENT
   end if
```

NOTES:

1.2.2.3.1.2.2 Aid Control Display. This process includes any modules that are added to the View Experiment Control process and aid the user in viewing a experiment control message or completing an experiment control form.

The process specification for the process Aid Control Display follows:

PROCESS NAME: AID_CONTROL_DISPLAY

PROCESS NUMBER: 2.3.1.2.2

DATA FLOW AND I/O USE:
I CONTROL_MESSAGE
I SUBJECT_INPUT

O AID_DISPLAY
O CONTROL_AID_DATA
O SUBJECT_ACTIONS

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.2.3 Display Control Overlays. This process displays the map overlay experiment control messages. It also displays the digital map and handles all the map control interactions.

The process specification for the process Display Control Overlays follows:

PROCESS NAME: DISPLAY_CONTROL_OVERLAYS

PROCESS NUMBER: 2.3.1.2.3

DATA FLOW AND I/O USE:
I CONTROL_MESSAGE

O OVERLAY_DISPLAY
O CONTROL_REQUEST

SPECIFICATION:
```
if DIGITAL_MAP_DISPLAYED
   add CONTROL_MESSAGE to OVERLAY_DISPLAY
else
   display DIGITAL_MAP
   display CONTROL_MESSAGE
end if
```

NOTES:

1.2.2.3.1.2.4 Manage Intelligent Interface. This process shall customize the user interface depending upon the contents of the knowledge base.

The process specification for the process Manage Intelligent Interface follows:

PROCESS NAME: MANAGE_INTELLIGENT_INTERFACE

PROCESS NUMBER: 2.3.1.2.4

DATA FLOW AND I/O USE:

I SUBJECT_ACTIONS

O TAILORED_INTERFACE

IO KNOWLEDGE_BASE

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.3 View C2 Situation. This process controls the window that allows the experiment participant to view the tactical situation products. These products can be textual reports, graphs, or map overlays. The products include the current and past situation. Products that are generated in the Build process and are transmitted to the database can be viewed by this process.

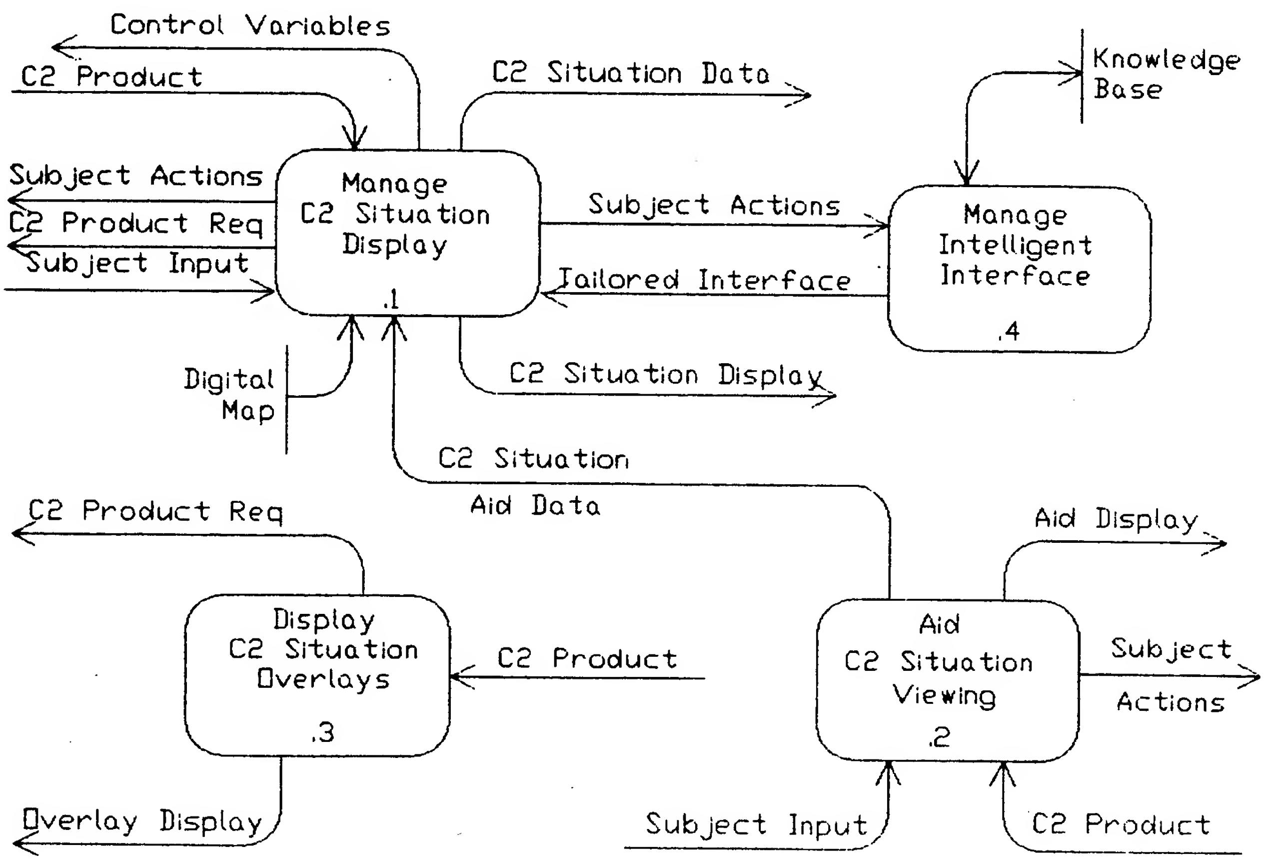


Figure 1.2.2.3-5 VIEW C2 SITUATION

The View C2 Situation process consists of those subordinate processes shown in Figure 1.2.2.3-5; Manager C2 Situation Display, Aid C2 Situation Viewing, Display C2 Situation Overlays, and Manage Intelligent Interface.

1.2.2.3.1.3.1 Manage C2 Situation Display. This process handles all user interactions with the view situation display. The main interaction with the user is to display the walking menu to allow selection of the desired C2 product and to display the selected product. This process also must determine when to use a C2 situation aid, whether to display a product as a textual report, graph, or map overlay and must interface with the intelligent interface software.

The process specification for the process Manage C2 Situation Display follows:

```
PROCESS NAME: MANAGE_C2_SITUATION_DISPLAY

PROCESS NUMBER: 2.3.1.3.1

DATA FLOW AND I/O USE:
   I     DIGITAL_MAP
   I     C2_SITUATION_AID_DATA
   I     C2_PRODUCT
   I     SUBJECT_INPUT
   I     TAILORED_INTERFACE

   O     CONTROL_VARIABLES
   O     C2_SITUATION_DATA
   O     C2_SITUATION_DISPLAY
   O     C2_PRODUCT_REQ
   O     SUBJECT_ACTIONS

SPECIFICATION:
   loop until WINDOW_ELIMINATED
      accept REPORT_SELECTION
      request PRODUCT from CONTROL_C2_PRODUCTS
      read PRODUCT from CONTROL_C2_PRODUCTS
      if TEXTUAL_REPORT
         display TEXTUAL_REPORT
      else if GRAPH
         display GRAPH
      else if MAP_OVERLAY
         do DISPLAY_C2_SITUATION_OVERLAYS
      end if
   end loop

NOTES:
```

1.2.2.3.1.3.2 Aid C2_Situation Viewing. This process includes any

modules that are added to the View C2 Situation process and aid the user in viewing a C2 situation product.

The process specification for the process Aid C2 Situation Viewing follows:

PROCESS NAME: AID_C2_SITUATION_VIEWING

PROCESS NUMBER: 2.3.1.3.2

DATA FLOW AND I/O USE:
I C2_PRODUCT
I SUBJECT_INPUT

O AID_DISPLAY
O C2_SITUATION_AID_DATA
O SUBJECT_ACTIONS

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.3.3 Display C2 Situation Overlays. This process displays the map overlay situation products. It also displays the digital map and handles all the map control interactions. Multiple C2 products may be displayed simultaneously on the map.

The process specification for the process Display C2 Situation Overlays follows:

PROCESS NAME: DISPLAY_C2_SITUATION_OVERLAYS

PROCESS NUMBER: 2.3.1.3.3

DATA FLOW AND I/O USE:
I C2_PRODUCT

O OVERLAY_DISPLAY
O C2_PRODUCT_REQUEST

SPECIFICATION:
```
if DIGITAL_MAP_DISPLAYED
   add PRODUCT to OVERLAY_DISPLAY
else
   display DIGITAL_MAP
   display PRODUCT
end if
```

NOTES:

1.2.2.3.1.3.4 Manage Intelligent Interface. This process shall customize the user interface depending upon the contents of the knowledge base.

The process specification for the process Manage Intelligent Interface follows:

PROCESS NAME: MANAGE_INTELLIGENT_INTERFACE

PROCESS NUMBER: 2.3.1.3.4

DATA FLOW AND I/O USE:
I SUBJECT_ACTIONS

O TAILORED_INTERFACE

IO KNOWLEDGE_BASE

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.4 View Message. This process controls the window that allows the experiment participant to view and process messages. These messages can be textual reports, graphs, or map overlays. The messages can originate from another participant, the experimenter or a simulation. The message processing shall include the capabilities to save and drop messages, scan saved messages, and scan the message log.

The View Message process consists of those subordinate processes shown in Figure 1.2.2.3-6; Manager Message Display, Aid Message Processing, Display Message Overlays, and Manage Intelligent Interface.

1.2.2.3.1.4.1 Manage Message Display. This process handles all user interactions with the view message display. The main interaction with the user is to display the incoming messages and allow the user to save or drop a message and also to scan the saved messages and the message log. This process also must determine when to use a message aid, whether to display a product as a textual report, graph, or map overlay and must interface with the intelligent interface software.

The process specification for the process Manage Message Display follows:

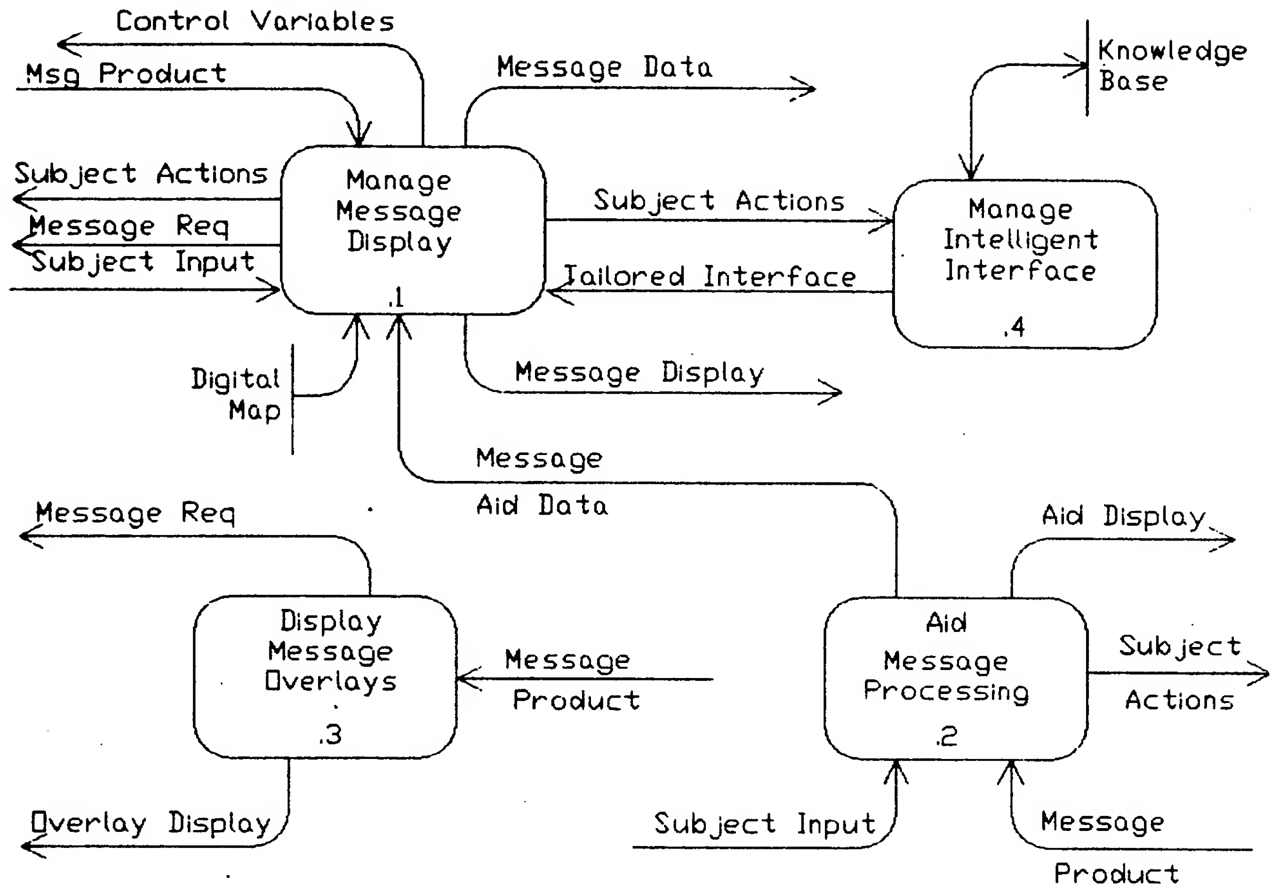


Figure 1.2.2.3-6 VIEW MESSAGE

PROCESS NAME: MANAGE_MESSAGE_DISPLAY

PROCESS NUMBER: 2.3.1.4.1

DATA FLOW AND I/O USE:

I	DIGITAL_MAP
I	MESSAGE_AID_DATA
I	MSG_PRODUCT
I	SUBJECT_INPUT
I	TAILORED_INTERFACE
O	CONTROL_VARIABLES
O	MESSAGE_DATA
O	MESSAGE_DISPLAY
O	MESSAGE_REQ
O	SUBJECT_ACTIONS

SPECIFICATION:

```
loop until WINDOW_ELIMINATED
   accept MESSAGE_OPTION
```

```
    if NEW_MESSAGE
       read MESSAGE from CONTROL_C2_PRODUCTS
       if DISPLAY_BLANK
          display MESSAGE
       else
          increment WAIT_COUNTER in DROP_BUTTON
       end if
    else if DROP_BUTTON
       erase MESSAGE_DISPLAY
       if WAIT_COUNTER > 0
          read MESSAGE from CONTROL_C2_PRODUCTS
          display MESSAGE
          decrement WAIT_COUNTER in DROP_BUTTON
       end if
    else if SAVE_BUTTON
       add MESSAGE to SAVE_QUEUE
       increment SAVE_COUNTER in SAVE_BUTTON
       erase MESSAGE_DISPLAY
       if WAIT_COUNTER > 0
          read MESSAGE from CONTROL_C2_PRODUCTS
          display MESSAGE
          decrement WAIT_COUNTER in DROP_BUTTON
       end if
    else if SCAN_SAVE
       display SAVE_LIST
       accept SAVE_SELECTION
       read MESSAGE from CONTROL_C2_PRODUCTS
       display MESSAGE
    else if SCAN_LOG
       display LOG_LIST
       accept LOG_SELECTION
       read MESSAGE from CONTROL_C2_PRODUCTS
    end if
 end loop
```

NOTES:

1.2.2.3.1.4.2 Aid Message Processing. This process includes any modules that are added to the View Message process and aid the user in message processing.

The process specification for the process Aid Message Processing follows:

PROCESS NAME: AID_MESSAGE_PROCESSING

PROCESS NUMBER: 2.3.1.4.2

DATA FLOW AND I/O USE:

```
   I     MESSAGE_PRODUCT
   I     SUBJECT_INPUT
```

```
   O     AID_DISPLAY
   O     MESSAGE_AID_DATA
   O     SUBJECT_ACTIONS
```

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.1.4.3 Display Message Overlays. This process displays the map overlay messages. It also displays the digital map and handles all the map control interactions.

The process specification for the process Display Message Overlays follows:

PROCESS NAME: DISPLAY_MESSAGE_OVERLAYS

PROCESS NUMBER: 2.3.1.4.3

```
DATA FLOW AND I/O USE:
   I     MESSAGE_PRODUCT

   O     OVERLAY_DISPLAY
   O     MESSAGE_REQ
```

```
SPECIFICATION:
   if DIGITAL_MAP_DISPLAYED
      add MESSAGE to OVERLAY_DISPLAY
   else
      display DIGITAL_MAP
      display MESSAGE
   end if
```

NOTES:

1.2.2.3.1.4.4 Manage Intelligent Interface. This process shall customize the user interface depending upon the contents of the knowledge base.

The process specification for the process Manage Intelligent Interface follows:

PROCESS NAME: MANAGE_INTELLIGENT_INTERFACE

PROCESS NUMBER: 2.3.1.4.4

```
DATA FLOW AND I/O USE:
   I     SUBJECT_ACTIONS

   O     TAILORED_INTERFACE
```

IO KNOWLEDGE_BASE

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.2 Control C2 Products

This process is the maintainer of the Command and Control product and message database. It accepts requests for products, formats the products, and transmits them back to the requesting process. If a product requires tactical situation data, this process requests the data from the maintain tactical situation process and inserts it into the product. This process accepts new products from the build C2 products process, adds them to the C2 product database, and routes them to the appropriate participants.

The process specification for the process Control C2 Products follows:

PROCESS NAME: CONTROL_C2_PRODUCTS

PROCESS NUMBER: 2.3.2

DATA FLOW AND I/O USE:

```
I     C2_PRODUCT_REQ
I     SITUATION_DATA

O     C2_PRODUCTS
O     SITUATION_REQUESTS

IO    C2_PRODUCT_DB
```

SPECIFICATION:

```
loop until EXPERIMENT_COMPLETE
   accept C2_PRODUCT_REQ
   if READ_PRODUCT
      read PRODUCT from C2_PRODUCT_DB
      if PRODUCT requires SITUATION_DATA
         request SITUATION_DATA from SITUATION_DB_MANAGER
         read SITUATION_DATA from SITUATION_DB_MANAGER
         insert SITUATION_DATA into PRODUCT
      end if
      send PRODUCT to REQUESTOR
   else if NEW_PRODUCT
      add PRODUCT to C2_PRODUCT_DB
      if PRODUCT contains SITUATION_DATA
         send SITUATION_UPDATE to SITUATION_DB_MANAGER
```

```
         end if
      else if CHANGE_PRODUCT
         read PRODUCT from C2_PRODUCT_DB
         update PRODUCT
         write PRODUCT to C2_PRODUCT_DB
         if PRODUCT contains SITUATION_DATA
            send SITUATION_UPDATE to SITUATION_DB_MANAGER
         end if
      end if
   end loop
```

NOTES:

1.2.2.3.3 Operate Tools

This process shall manage the window where non-scenario dependent tools and aids are made available to the user. In the initial EDDIC design, only a notepad tool will exist in this window. The notepad tool will provide the user with a place to organize textual information. The information can be copied from the other windows or be entered from the keyboard.

The process specification for the process Operate Tools follows:

PROCESS NAME: OPERATE_TOOLS

PROCESS NUMBER: 2.3.3

DATA FLOW AND I/O USE:

```
   I     PRODUCT_DATA
   I     SUBJECT_INPUT

   O     TOOL_DISPLAY
   O     SUBJECT_ACTIONS
```

SPECIFICATION:

```
   accept TOOL_TYPE
   if NOTEPAD
      invoke FULL_EDITOR
      loop until WINDOW_ELIMINATED
         accept EDITOR_TRANSACTION
         process EDITOR_TRANSACTION
      end loop
   end if
```

NOTES:

1.2.2.3.4 Build C2 Products

This process controls the window that allow the experiment participants to view build and transmit Command and Control

products. The products will be fill in the blank forms or tactical map overlays.

The Build C2 Products process consists of those subordinate processes shown in Figure 1.2.2.3-7; Manage Build Display, Aid Product Development, Display Product Overlays, and Manage Intelligent Interface.

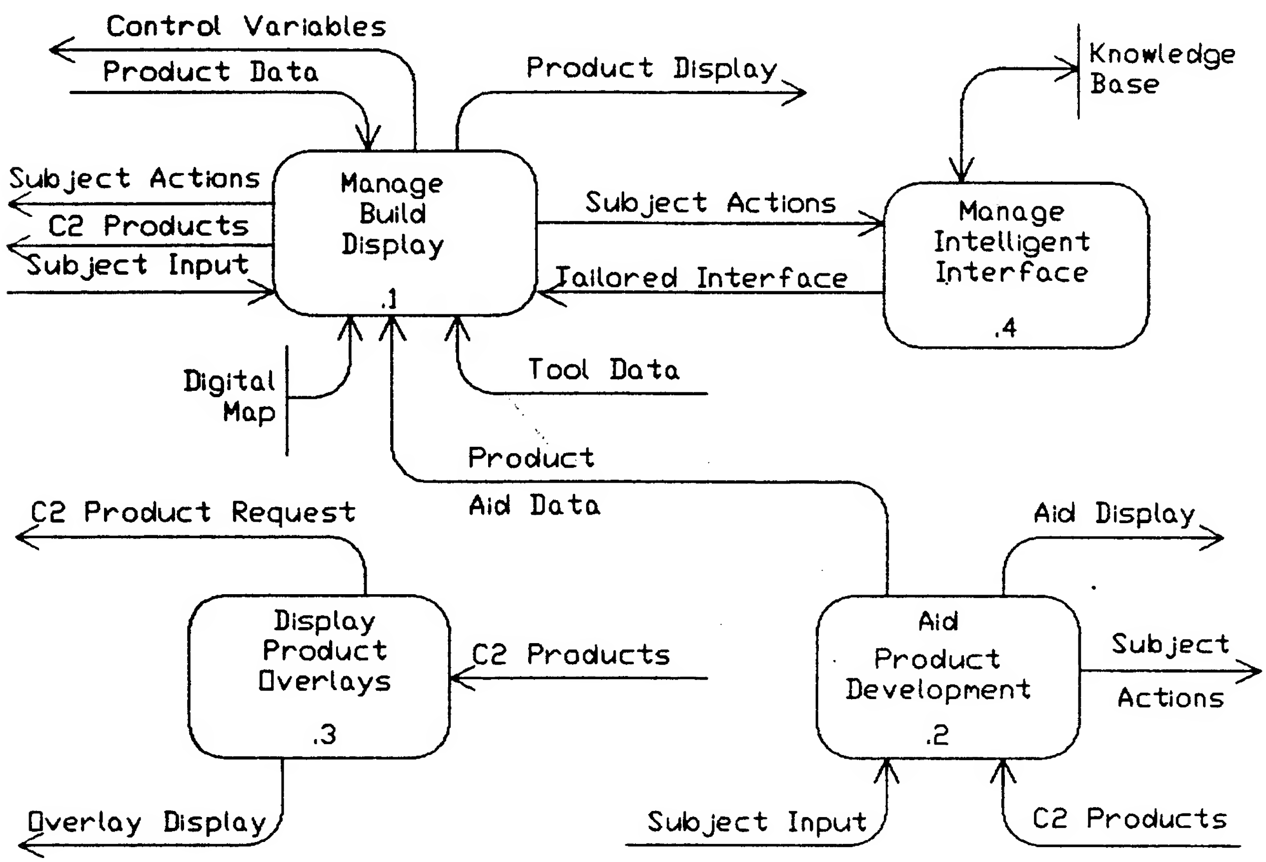


Figure 1.2.2.3-7 BUILD C2 PRODUCTS

1.2.2.3.4.1 Manage Build Display. This process handles all user interactions with the Build C2 Products display. The main interaction with the user is to display the walking menu to allow selection of the C2 reference product and to display the selected product. This process also must determine when to use a product development aid, whether to display a product template as a textual form or map overlay and must interface with the intelligent interface software.

The process specification for the process Manage Build Display follows:

PROCESS NAME: MANAGE_BUILD_DISPLAY

PROCESS NUMBER: 2.3.4.1

DATA FLOW AND I/O USE:

```
I     DIGITAL_MAP
I     PRODUCT_AID_DATA
I     PRODUCT_DATA
I     SUBJECT_INPUT
I     TAILORED_INTERFACE
I     TOOL_DATA

O     CONTROL_VARIABLES
O     C2_PRODUCTS
O     PRODUCT_DISPLAY
O     SUBJECT_ACTIONS
```

SPECIFICATION:

```
loop until WINDOW_ELIMINATED
   accept PRODUCT_SELECTION
   read PRODUCT_FORM from MANAGE_C2_PRODUCTS
   if TEXTUAL_PRODUCT
      display TEXTUAL_FORM
   else if MAP_OVERLAY_PRODUCT
      do DISPLAY_REFERENCE_OVERLAYS
   end if
end loop
```

NOTES:

1.2.2.3.4.2 Aid Product Development. This process includes any modules that are added to the Build C2 Products process and aid the user in developing Command and Control products.

The process specification for the process Aid Product Development follows:

PROCESS NAME: AID_PRODUCT_DEVELOPMENT

PROCESS NUMBER: 2.3.4.2

DATA FLOW AND I/O USE:

```
I     C2_PRODUCTS
I     SUBJECT_INPUT

O     AID_DISPLAY
O     PRODUCT_AID_DATA
O     SUBJECT_ACTIONS
```

SPECIFICATION:

To be Determined

NOTES:

1.2.2.3.4.3 Display Product Overlays. This process displays the map overlay products and accepts user input to define and update a product. It also displays the digital map and handles all the map control interactions. Multiple products may be displayed simultaneously on the map.

The process specification for the process Display Product Overlays follows:

PROCESS NAME: DISPLAY_PRODUCT_OVERLAYS

PROCESS NUMBER: 2.3.4.3

DATA FLOW AND I/O USE:

```
I     C2_PRODUCT

O     OVERLAY_DISPLAY
O     C2_PRODUCT_REQUEST
```

SPECIFICATION:

```
if DIGITAL_MAP_DISPLAYED
   add PRODUCT to OVERLAY_DISPLAY
else
   display DIGITAL_MAP
   display PRODUCT
end if
accept PRODUCT_UPDATES
```

NOTES:

1.2.2.3.4.4 Manage Intelligent Interface. This process shall customize the user interface depending upon the contents of the knowledge base.

The process specification for the process Manage Intelligent Interface follows:

PROCESS NAME: MANAGE_INTELLIGENT_INTERFACE

PROCESS NUMBER: 2.3.4.4

DATA FLOW AND I/O USE:

```
I     SUBJECT_ACTIONS

O     TAILORED_INTERFACE

IO    KNOWLEDGE_BASE
```

SPECIFICATION:

To be Determined

NOTES:

1.2.2.4 Record Experiment

This process records experiment transactions that are required for post-experiment analysis. The transactions are transmitted from the processes that control the EDDIC windows.

The process specification for the process Record Experiment follows:

PROCESS NAME: RECORD_EXPERIMENT

PROCESS NUMBER: 2.4

DATA FLOW AND I/O USE:

```
I     EXPERIMENTER_ACTIONS
I     SUBJECT_ACTIONS

O     EXPERIMENT_LOG
```

SPECIFICATION:

```
loop until EXPERIMENT_COMPLETE
   accept TRANSACTION
   add TRANSACTION to EXPERIMENT_LOG_DB
end loop
```

NOTES:

1.2.3 Analyze Experiment

This process uses the experiment log to perform analysis on experiment. The details of this analysis have not been identified as of this date and will be very dependent upon the requirements from task 3 and 4.

The process specification for the process Analyze Experiment follows:

PROCESS NAME: ANALYZE_EXPERIMENT

PROCESS NUMBER: 3

DATA FLOW AND I/O USE:

```
I     EXPERIMENT_DB
I     EXPERIMENT_LOG
I     ANALYSIS_INPUT

O     EXPERIMENT_REPORTS
```

SPECIFICATION:

To be Determined

NOTES:

1.3 EDDIC SOLDIER MACHINE INTERFACE (SMI)

The EDDIC Soldier Machine Interface (SMI) shall be hosted on a high-resolution color graphics workstation. An example of the screen lay-out is shown in Figure 1.3-1. The interface shall be based on a window and icon protocol and user selection and input shall be through the mouse or keyboard. Sections 1.3.1 and 1.3.2 describe attributes of the interface that are common to all the windows and section 1.3.3 describes the detail design of each window in EDDIC.

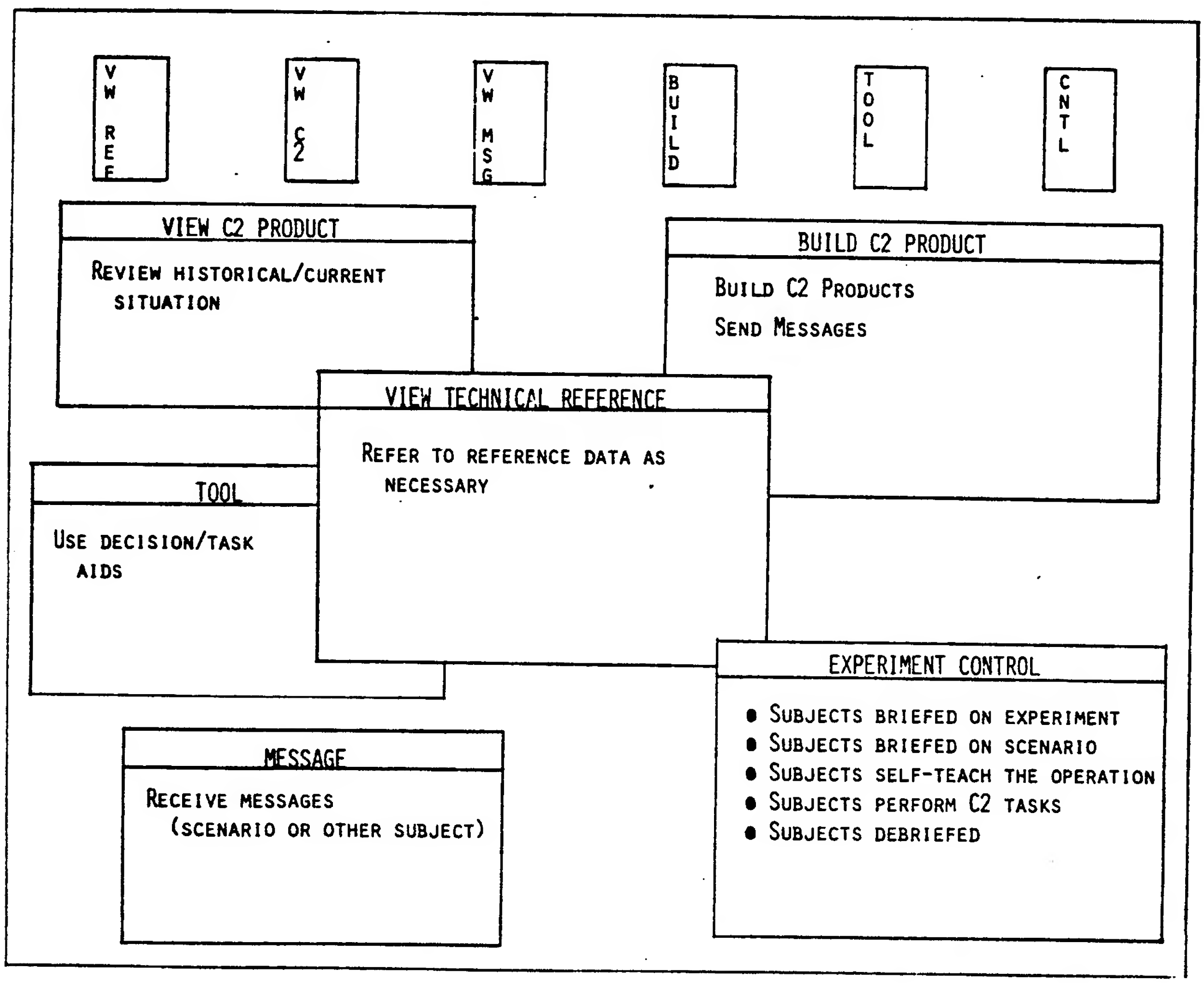


Figure 1.3-1 EDDIC SCREEN LAYOUT

1.3.1 Window Operations

The EDDIC windowing system shall be a dynamic interface which allows the user to select the number, type, location and size of the windows to display. These operations shall be invoked by interaction between the window border and the mouse. All windows shall also have a scroll capability which is controlled with the mouse and scroll bars displayed along the left side and bottom of the window.

1.3.1.1 Window Creation

An EDDIC window is created by moving the cursor over the desired window creation button on the top of the screen and depressing the select mouse button (left button). Figure 1.3-1 shows the location of the window creation buttons. The following types of windows can be created in EDDIC:

View Technical Reference
View Tactical Situation
View Messages
Build Products
Tools

After the desired button is selected, a transparent rectangle appears on the screen and defines the location and size of the new window. The location is adjusted by moving the mouse. If the default size is acceptable, the location is set by hitting the mouse select button (left button). The size of the window can be set by using the mouse adjust button (middle button) to define the upper left and lower right corners of the window.

1.3.1.2 Window Border Operations

The window border operations (frame operations) provide a friendly and consistent interface for controlling the windows on the display. Each window shall have common attributes which provide the user a friendly interface with the following capabilities:

- o Close - Change Window into icon
- o Move - Change the location of the window
- o Resize - Change the size of the window
- o Expose - Make the selected window display on top of other windows in the same location
- o Hide - Make the selected window display below other windows in the same location
- o Redisplay - Redraw the displayed information in the

window

- o Zoom - Change the height of the window to the full height of the screen. If a window is already zoomed, this option will change the window back to its original size.
- o Terminate - Remove the window from the display

The above capabilities shall be invoked by moving the cursor into the window border. Figure 1.3.1.2-1 shows a sample layout of a window and Figure 1.3.1.2-2 shows the interface between the mouse buttons and the window border.

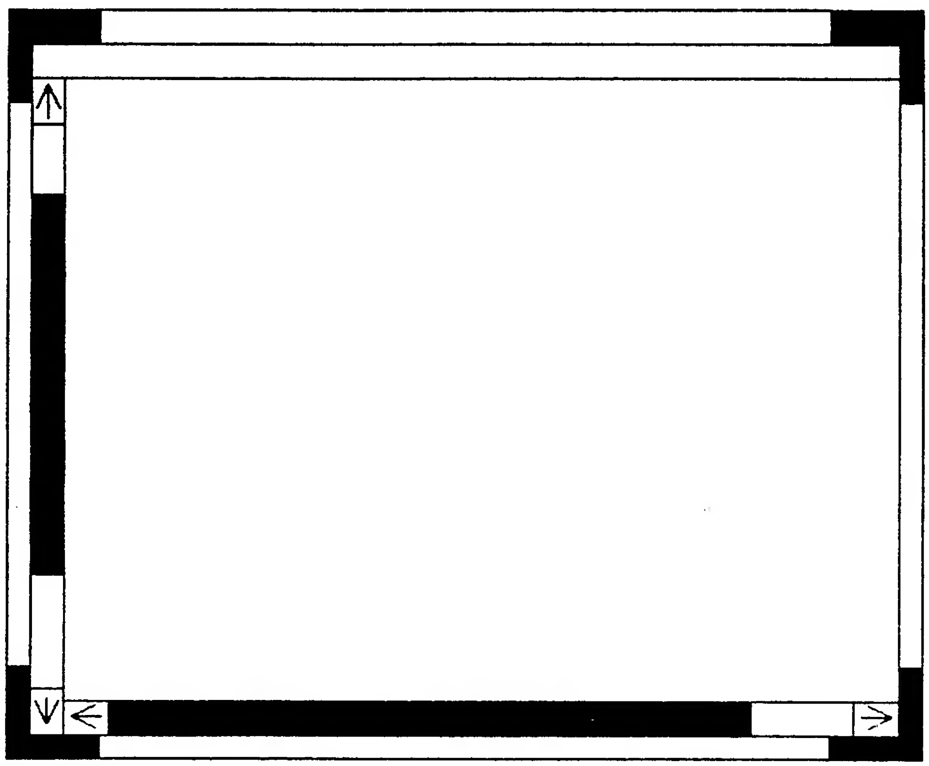


Figure 1.3.2.1-1 WINDOW LAYOUT

The user shall have the option of performing window operations by selecting options from a pop-up menu or by hitting mouse buttons in certain locations of the window. The pop-up menu, shown in Figure 1.3.2.1-2, is initiated by hitting the Pop-Up Menu mouse button (right button) while the cursor is located in the window

border. The desired selection is made on the pop-up menu by moving the mouse over the desired option and releasing the mouse button. Instructions shall be displayed to help the user perform any option selected from the pop-up menu.

The following window options can be invoked by the user without using the pop-up menu:

- o Move - Change the location of the window
- o Resize - Change the size of the window

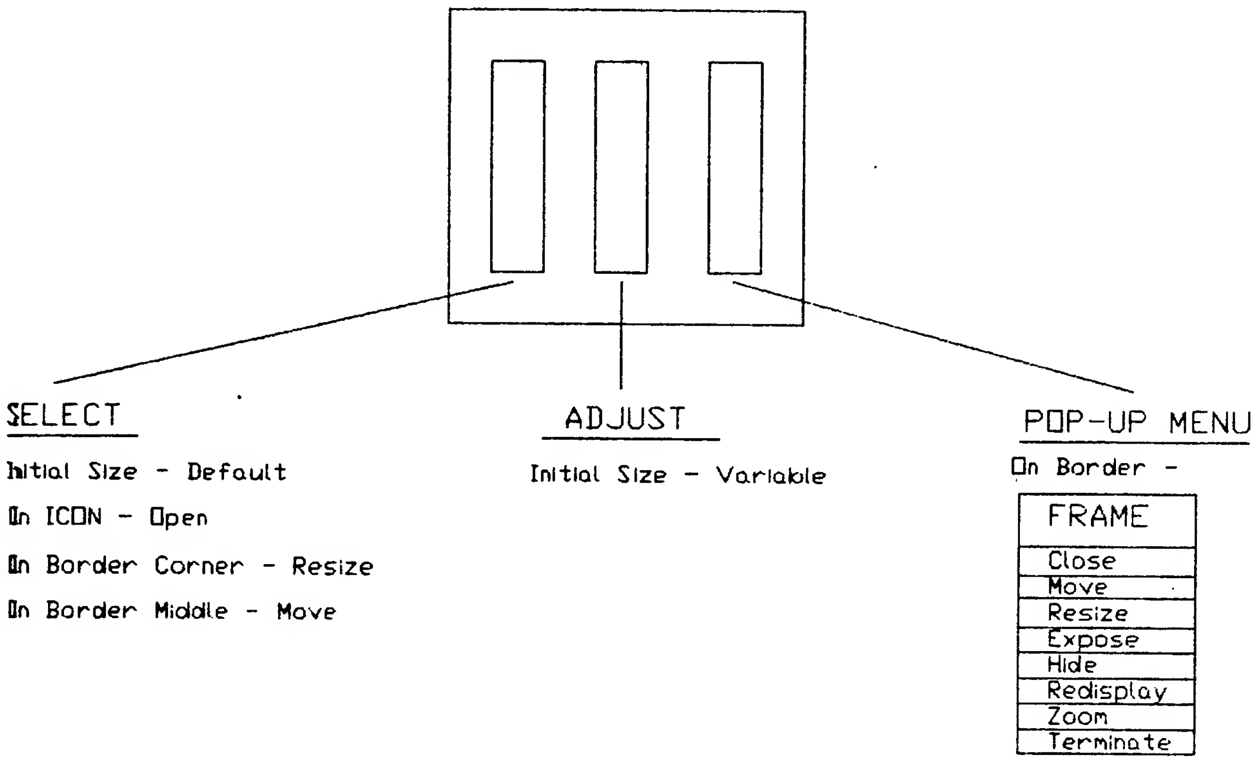


Figure 1.3.2.1-2 MOUSE / WINDOW INTERFACE

The window Move option shall be invoked by hitting the Select mouse button (left button) while the cursor is located in the middle section of the border. The middle section of the border is defined as any part of the border excluding the shaded corners. When the Move option is invoked, a Move rectangle, the same size and at the same location as the selected window, shall be displayed on the screen and shall track with all mouse movements until the select mouse button is released. When the button is released, the window

shall be erased from its previous location and be displayed at the location of the Move rectangle.

The window Resize option shall be invoked by hitting and releasing the Select mouse button (left button) while the cursor is located in one of the border corners. The corners shall be shaded for easy identification. When the Resize option is invoked, a Resize rectangle, the same size and at the same location as the selected window, shall be displayed on the screen and the corner nearest the selection point shall track with all mouse movements until the Select mouse button is depressed and released. The corner opposite of the selected corner shall not move during the Resize operation. When the button is released, the window shall be erased and redisplayed according to the new size definition.

1.3.1.3 Scrolling Operations

All EDDIC windows shall have a scroll bar along the left side and bottom of the window. They will provide the capability to change which part of a document is displayed in the window. Interaction with the scroll bar shall be accomplished via the Select mouse button (left button). The scroll bar shall allow scrolling up, scrolling down and relocating the window within the document. Figure 1.3.1.2-1 shows an example of a scroll bar. The shaded area in the middle of the bar indicates the size and location of the display in relation to the whole document.

The arrow at the top of the scroll bar shall move the display towards the beginning of the document. The arrow at the bottom of the scroll bar shall move the display towards the end of the document.

The part of the document that is displayed can be changed by selecting the shaded section of the bar and sliding it up or down with the mouse Select button depressed. Releasing the Select mouse button will cause the appropriate section of the document to be displayed. The part of the document to display can also be selected by hitting the Select mouse button at the desired location in the scroll bar.

1.3.1.4 Icons

Icons provide a convenient and user friendly way to put a window aside so a new window can be displayed. EDDIC icons shall be displayed across the top of the screen with each window type having an individual icon stack. The stacks shall appear on top of the window creation buttons on top of the screen. A maximum of seven icons can appear in a stack.

An existing window is changed into an icon by selecting the close option as described in section 1.3.1.2. The icon shall be

added to the icon stack in the order the windows were created. The icons shall be labeled with the following abbreviations followed by sequential letters indicating the order of creation of the window of that type:

REF - View Technical Reference

SIT - View Tactical Situation

MSG - View Message

BLD - Build Product

TOOL - Tool

CTL - Experiment Control

When a window is changed into an icon, it still remains active and can communicate with the display and with other processes in the system.

An icon is changed back into a window by selecting it from the icon stack with the Select mouse button (left button). The window will be displayed at the same location and with the same size that it had before it was changed into an icon.

1.3.2 Window Contents

The contents of EDDIC windows will vary depending upon the type and format of the data being presented. Textual data shall be handled by a mouse based text editor. Tactical map overlays shall be displayed on top of color digital map. Some numerical data shall be displayed in business graphs and data will be accepted from the user by fill-in-the-blank forms. The format and interface of each of these displays are described in this section.

1.3.2.1 Text Editor

The Text Editor described in this section applies to the textual displays in EDDIC. Some of the windows provide full user editing capability, while others are read-only. All editing functions shall be accomplished by a combination of mouse and keyboard inputs.

1.3.2.1.1 Full Capability Text Editor

The full editing windows shall allow the user complete full screen editing capabilities in a user friendly manner. The editing functions can be invoked either by using the mouse and pop-up menus or by using control keys. Figure 1.3.2.1-1 shows the interaction between the editor and the above mentioned interfaces.

1.3.2.1.1.1 Inserting Text. Text is inserted into a document by locating the insert point using the mouse cursor or arrow keys and selecting the insert point by hitting the Select mouse button (left button). After the insert point is selected, text is entered by typing the desired input on the keyboard. Text shall be inserted in front of the selected character. Typing errors can be corrected using the backspace key.

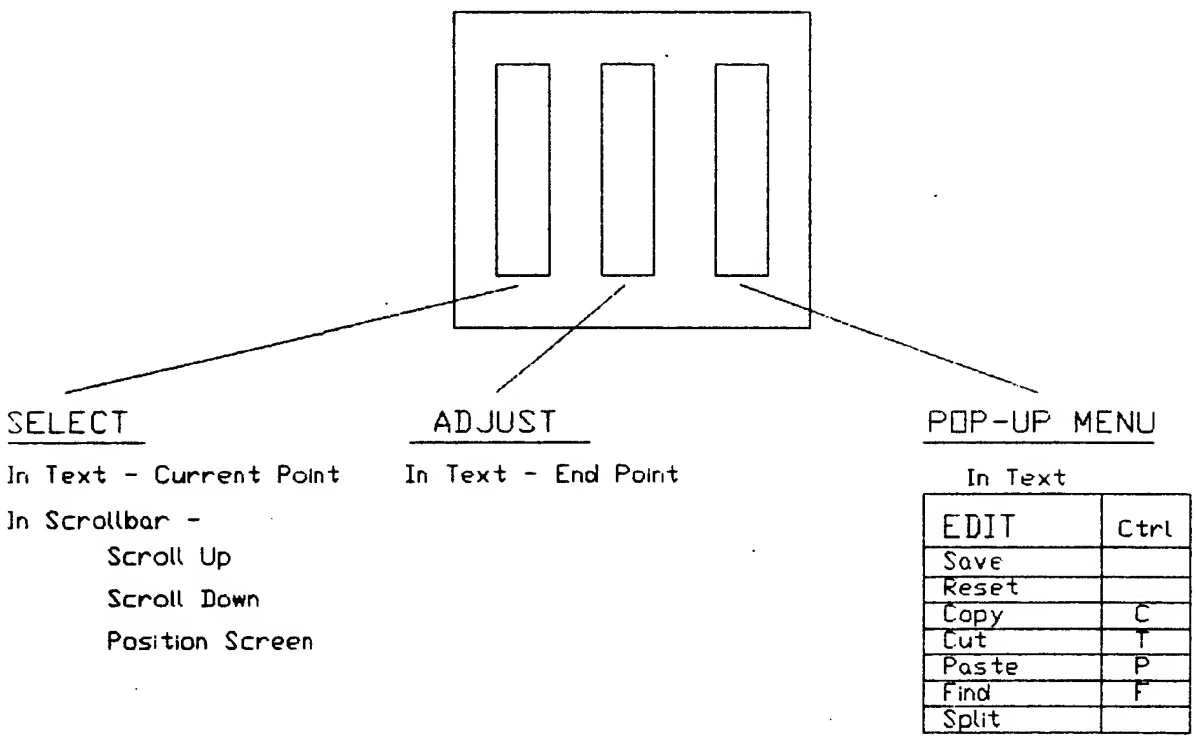


Figure 1.3.2.1-1 MOUSE / EDITOR INTERFACE

1.3.2.1.1.2 Selecting Text. Most editing commands are performed on text that has been selected. Text is selected by selecting the first character using the Select mouse button (left button) and selecting the last character using the Adjust mouse button (middle button). The last character position can dynamically be changed by holding down the Adjust button while moving the mouse to the desired location. The following commands use selected text to perform their operations:

Find
Copy
Cut

1.3.2.1.1.3 Using the Pop-up Menu. The edit pop-up menu shall be invoked by moving the cursor into the document section of the window

and hitting the Pop-up Menu mouse button (right button). The menu shall be displayed until the button is released. Options on the menu can be selected by moving the mouse until the desired option is backlighted and releasing the mouse button. Only valid menu options will be backlighted when they are selected. The format of the edit pop-up menu is shown in figure 1.3.2.1-1.

1.3.2.1.1.4 Saving Changes. The save is accomplished by invoking the edit pop-up menu (see section 1.3.2.1.1.3) and selecting the Save option. All changes made to a document must be saved before the window is terminated. If a user tries to terminate a window before the changes are saved, a warning messages will appear that will force the user to either perform a save or a reset.

1.3.2.1.1.5 Reset a Window. The reset is accomplished by invoking the edit pop-up menu (see section 1.3.2.1.1.3) and selecting the Reset option. After the selection of the reset, instructions shall be displayed to tell the user to hit the left mouse button to confirm the reset, and that any other button will cancel the reset operation. When the reset is confirmed, all changes since the last save will be removed from the document.

1.3.2.1.1.6 Copying Text. Copying text in a window shall be accomplished by selecting the desired text (see section 1.3.2.1.2) and performing the copy operation by hitting "CTRL C" or by invoking the edit pop-up menu (see section 1.3.2.1.1.3) and selecting the Copy option. The copied text can be inserted into any full edit textual window by performing a Paste operation (see section 1.3.2.1.1.8).

1.3.2.1.1.7 Cutting Text. Cutting text is similar to copying text, except the selected text is deleted from the document. The Cut operation shall be accomplished by selection the desired text (see section 1.3.2.1.1.2) and performing the cut operation by hitting "CTRL T" or by invoking the edit pop-up menu (see section 1.3.2.1.1.3) and selecting the Cut option. The cut text can be inserted into the same window or any other full edit textual window by performing a Paste operation (see section 1.3.2.1.1.8).

1.3.2.1.1.8 Pasting Text. Text shall be pasted in a window by selecting the desired paste location with the mouse and inserting the text by hitting "CTRL P" or by invoking the edit pop-up menu (see section 1.3.2.1.1.3) and selecting the Paste option. Text must be copied, section 1.3.2.1.1.6, or cut, section 1.3.2.1.1.7, before it can be pasted. Multiple selections of the Paste operation shall cause the cut or copied text to be inserted once for each time the paste is selected.

1.3.2.1.1.9 Finding Text. Finding a string in a window shall be accomplished by selecting the desired string (see section 1.3.2.1.1.2) and performing the Find operation by hitting a "CTRL F" or by invoking the edit pop-up menu (see section 1.3.3.1.3) and

selecting the Find option. Subsequent finds of the same string can be accomplished by performing the Find option without reaccomplishing the string selection.

1.3.2.1.1.10 Splitting the window. The Split option shall cause the edit window to be split horizontally across the middle and a separate scroll region shall be established for each split window. Updates to one split region shall update the other split region if they are displaying the same section of the document. The split option is invoked by display of the edit pop-up menu (see section 1.3.2.1.1.3) and selecting the Split option. If the window is already split, selection of this option will cause the window to return to a single scroll region.

1.3.2.1.2 Read-Only Windows.

The read-only windows usually contain reports where the user has viewing only editing capabilities. The following list includes the only editing options that are available in read-only windows:

Select Text
Find String
Copy Text
Split Window

The above edit options are described in section 1.3.2.1.1.

1.3.2.2 Walking Menus

Multiple level menu selections in EDDIC shall be accomplished using a Walking Menu technique. Figure 1.3.2.2-1 shows an example of a walking menu. The Walking Menu technique starts by moving the cursor over a report selection button and depressing the Select mouse button (Left button). The top level menu is displayed with arrows to the right of each selection that can be further subdivided. When the user moves the cursor over a menu entry, the walking menu shall be backlighted and moving the cursor over the arrow shall cause the submenu to be displayed. This process continues until the user selects an option that cannot be subdivided any further.

If the user moves the cursor back to a higher level menu and selects a new option, all submenus shall be erased and the user must move the cursor over the arrow to display the submenu for the newly selected option.

The Walking Menu process ends when the user selects a menu entry by releasing the mouse Select button (left button). If the selected option has an arrow displayed to the right of it, the applications software shall assign default selections for the submenus to the selected option.

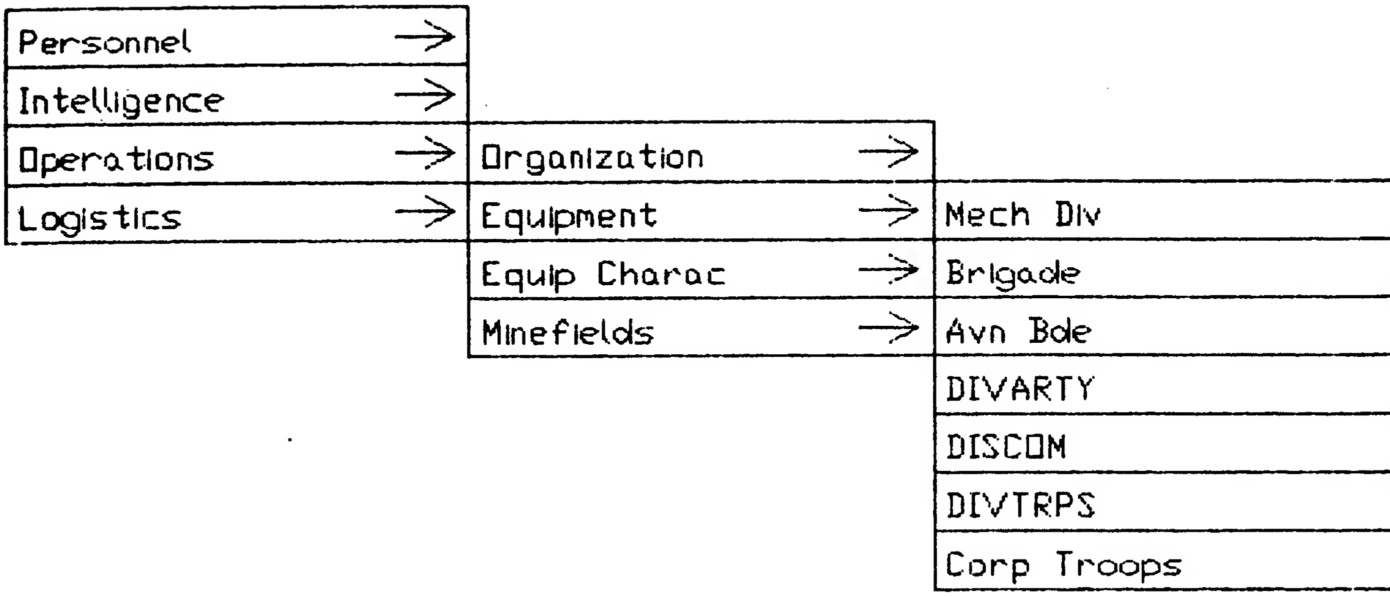


Figure 1.3.2.2-1 WALKING MENUS

1.3.2.3 Tactical Map

The tactical map shall be a color digitized image representing the area of the world where the scenario is located. The user shall be given the following map control options:

Background	Scale	Overlays
Vegetation	1:25000	Grids
Shaded Relief	1:50000	Contours
	1:125000	Roads
	1:500000	Hydrography
		Miscellaneous

Changing the map location shall be accomplished by either using the vertical and horizontal scroll bars or by selecting the desired center of the screen with the Adjust mouse button (middle button). The scroll bars shall operate the same as the textual scroll bars described in 1.3.1.3.

In the lower right corner of the map window a small window with a rectangle shall indicate the position of the screen within the digitized area. The size and location of the rectangle shall change in relation to the map scale and location.

1.3.2.4 Graphs

EDDIC reports containing numerical data shall be able to be displayed as graphs. The following types of graphs shall be integrated into EDDIC:

Line Graphs
Bar Charts
Pie Charts

1.3.2.5 Forms

Forms are required in EDDIC to allow a fill-in-the-blank capability. Each form will consist of static text and field descriptors. The following field types shall be supported in EDDIC:

Numeric
UTM Coordinates
String
Memo

All fields will be limited to a single line except for the Memo field. The memo field shall allow full text editing capabilities as described in 1.3.2.1.1 including vertical scrolling.

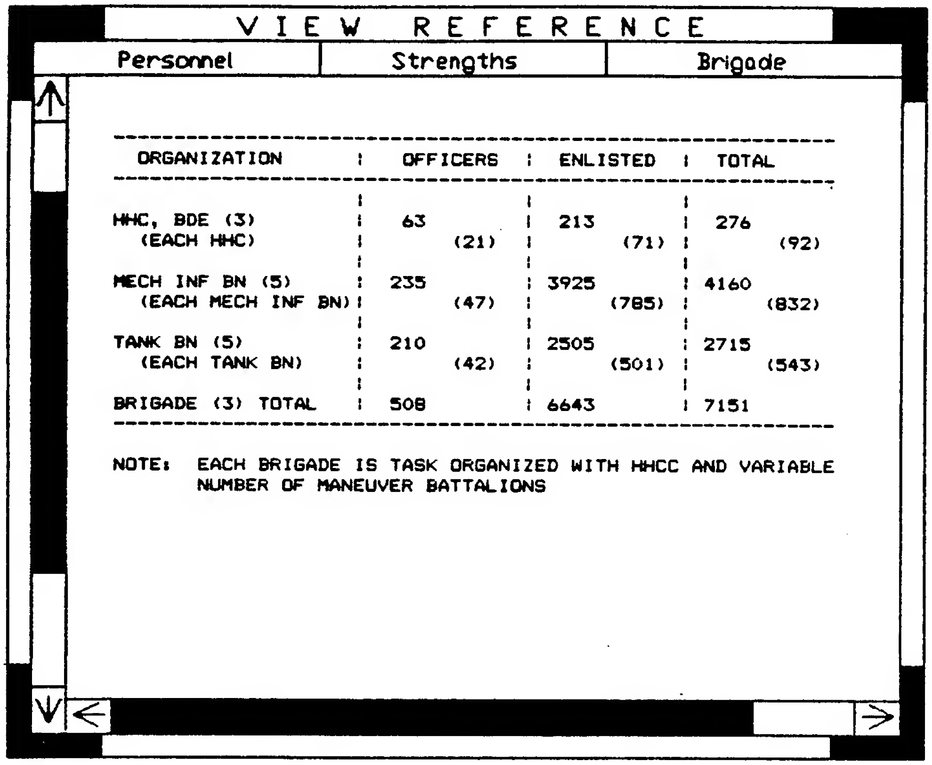
1.3.3 Window Definitions

EDDIC windows are defined by the function they perform rather than by the format of the window contents. The functions are based on the normal way an experiment participant would accomplish an assigned task. The basis of the EDDIC design is that the participant will work with products. The products may be viewed, built, and transmitted. Tools will be provided to help accomplish his tasks. This section describes the function and interface of the EDDIC windows.

1.3.3.1 Technical Reference

The Technical Reference window is used to view any information that would normally be found in a manual or book. TO&E data and equipment characteristics are examples of Technical Reference data. A reference product may be a textual report, graph, or digital map overlay. Multiple map overlay products may be simultaneously displayed on the map background. Figure 1.3.3.1-1 shows an example of a Technical Reference window.

The Technical Reference products shall be organized into functional areas, data categories and data elements. Reference products shall be selected using a walking menu as described in 1.3.2.2. The functional area, data category and data element for the selected product shall be displayed as buttons at the top of the window. Selection of the functional area button shall display a walking menu starting at the functional areas. Selection of the data category button shall display a walking menu starting with the data categories assigned to the displayed functional area. Selection of the data element button shall display a walking menu starting with the data elements assigned to the displayed data category and functional area.



VIEW REFERENCE

Personnel | Strengths | Brigade

ORGANIZATION	OFFICERS		ENLISTED		TOTAL	
HHC, BDE (3)	63		213		276	
(EACH HHC)		(21)		(71)		(92)
MECH INF BN (5)	235		3925		4160	
(EACH MECH INF BN)		(47)		(785)		(832)
TANK BN (5)	210		2505		2715	
(EACH TANK BN)		(42)		(501)		(543)
BRIGADE (3) TOTAL	508		6643		7151	

NOTE: EACH BRIGADE IS TASK ORGANIZED WITH HHCC AND VARIABLE NUMBER OF MANEUVER BATTALIONS

Figure 1.3.3.1-1 TECHNICAL REFERENCE WINDOW

1.3.3.2 Tactical Situation

The Tactical Situation window is used to view any information that pertains to the current or previous military situation. Unit locations, strengths and task organization and other battlefield situation data are included in Tactical Situation data. A situation product may be a textual report, graph, or digital map overlay. Multiple map overlay products may be simultaneously displayed on the map background. Figure 1.3.3.2-1 shows an example of a Tactical Situation window.

The Tactical Situation products shall be organized into functional areas, data categories, data elements, and date-time groups. Situation products shall be selected using a walking menu as described in 1.3.2.2. The functional area, data category, data element, and date-time for the selected product shall be displayed as buttons at the top of the window. Selection of the functional area button shall display a walking menu starting at the functional areas. Selection of the data category button shall display a walking menu starting with the data categories assigned to the displayed functional area. Selection of the data element button shall display a walking menu starting with the data elements assigned to the displayed data category and functional area. Selection of the date-

time button shall display a walking menu stating with the date-time entries assigned to the displayed data element, data category and functional area.

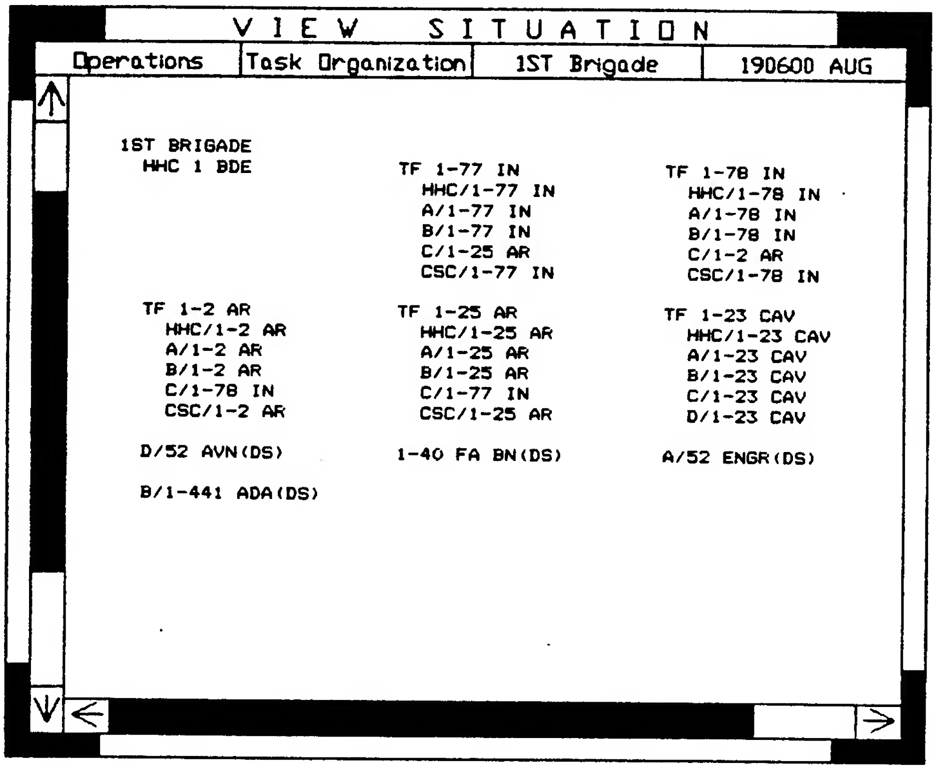


Figure 1.3.3.2 TACTICAL SITUATION WINDOW

1.3.3.3 Message

Incoming messages to an experiment participant are viewed and processed in the message window. Messages can be transmitted from another participant, the experimenter, or a simulation. Figure 1.3.3.3-1 shows an example of a message window.

The message window shall have the following buttons at the top of the window to help the participant process the messages:

SCAN LOG
SCAN SAVE
SAVE
DROP

The SCAN LOG button shall display a list of the messages that have been transmitted to the participant since the beginning of the experiment and allows the participant to select and display any of the messages in the list. The number of messages in the log is displayed in the SCAN LOG button.

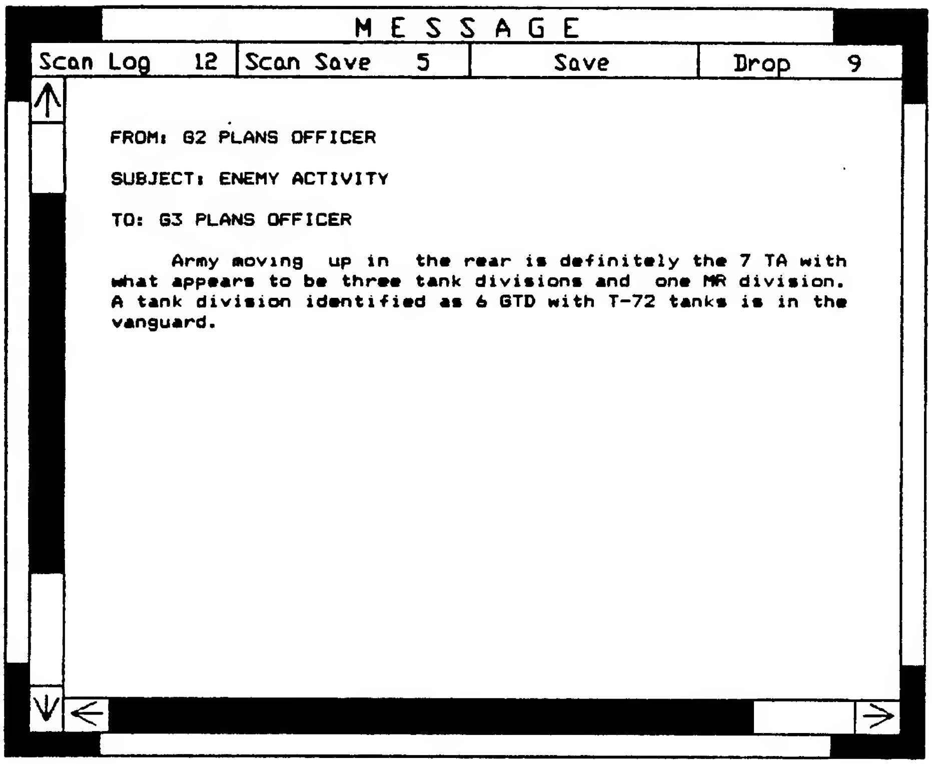


Figure 1.3.3.3-1 MESSAGE WINDOW

The SCAN SAVE button shall display a list of messages that have been saved by the SAVE option and allows the participant to select and display any of the messages in the list. The number of messages in the save queue is displayed in the SCAN SAVE button.

The SAVE button will add the current message to the save queue and erase the message from the display. If there are messages waiting to be displayed, the next message will automatically be displayed.

The DROP button will discard the displayed message. If the displayed message came from the save queue, the DROP button will delete it from the queue. The only way a message can be retrieved after it has been dropped is to perform a SCAN LOG. The number of messages waiting to be processed is displayed in the DROP button.

1.3.3.4 Build

The Build window is where the participants generate all the products required for the experiment. A product may be a textual form or digital map overlay. Multiple map overlay products may be simultaneously displayed on the map background. Figure 1.3.3.4-1 shows an example of a Build window.

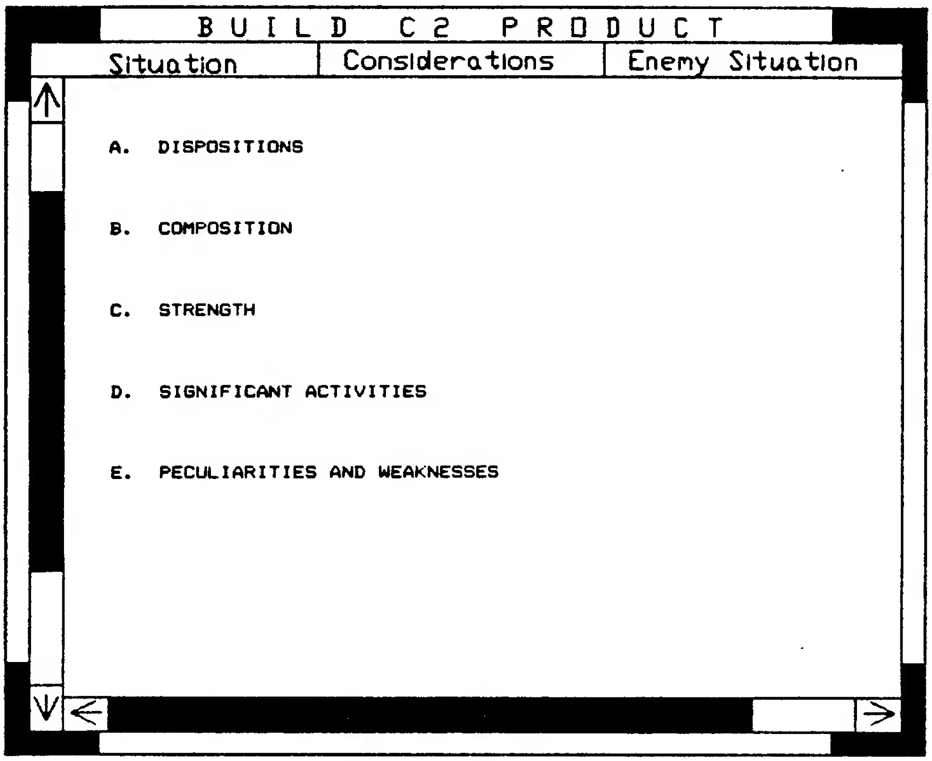


Figure 1.3.3.4-1 BUILD WINDOW

The products shall be organized into functional areas, data categories and data elements. Products shall be selected using a walking menu as described in 1.3.2.2. The functional area, data category and data element for the selected product shall be displayed as buttons at the top of the window. Selection of the functional area button shall display a walking menu starting at the functional areas. Selection of the data category button shall display a walking menu starting with the data categories assigned to the displayed functional area. Selection of the data element button shall display a walking menu starting with the data elements assigned to the displayed data category and functional area.

A product can be transmitted to any participant in the exercise and/or to the database. If a product is transmitted to the database, it will be added to the view tactical situation product list and can be viewed by all participants that are eligible to view the product. Messages sent only to another participant(s) will go only to the participants and cannot be viewed as a tactical product.

1.3.3.5 Tool

The Tool window contains exterior tools that will help the participant complete a task. The word exterior in this context means that the tool does not require tactical situation data or scenario data to operate. Note pads, spreadsheets and other off-line aids shall be integrated into this window. Figure 1.3.3.5-1 shows an example of the Tool window.

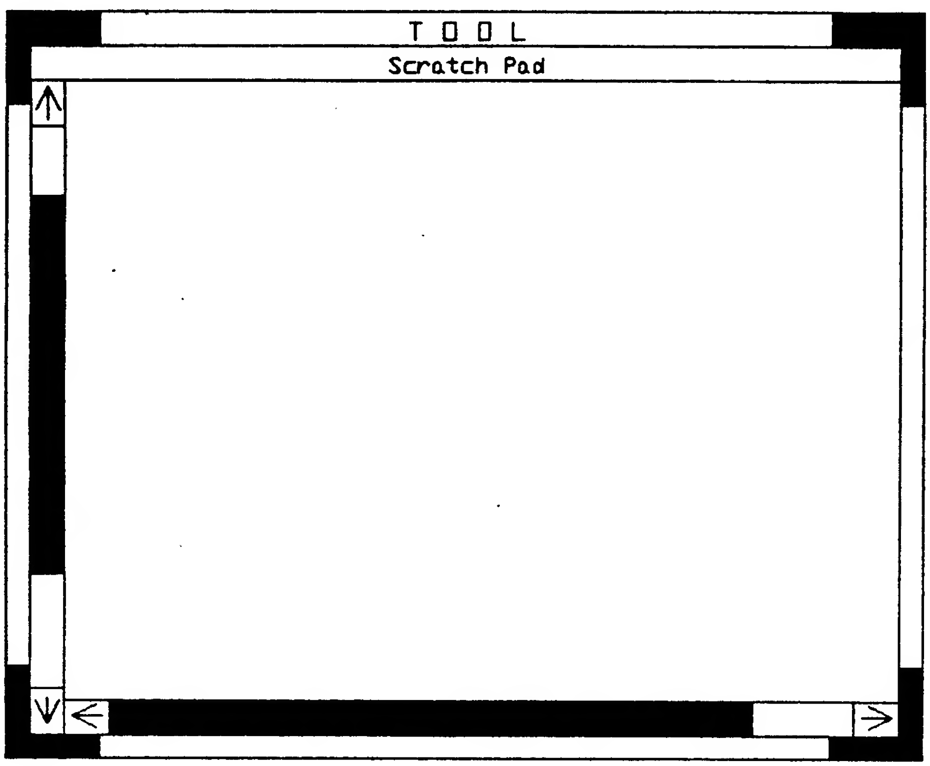


Figure 1.3.3.5-1 TOOL WINDOW

1.3.3.6 Experiment Control

The Experiment Control window is the place where the experimenter or an experiment control rule base communicates with the experiment participants. Experiment guidance, specific instructions and prompts for information are handled in this window. Figure 1.3.3.6-1 shows an example of an Experiment Control window.

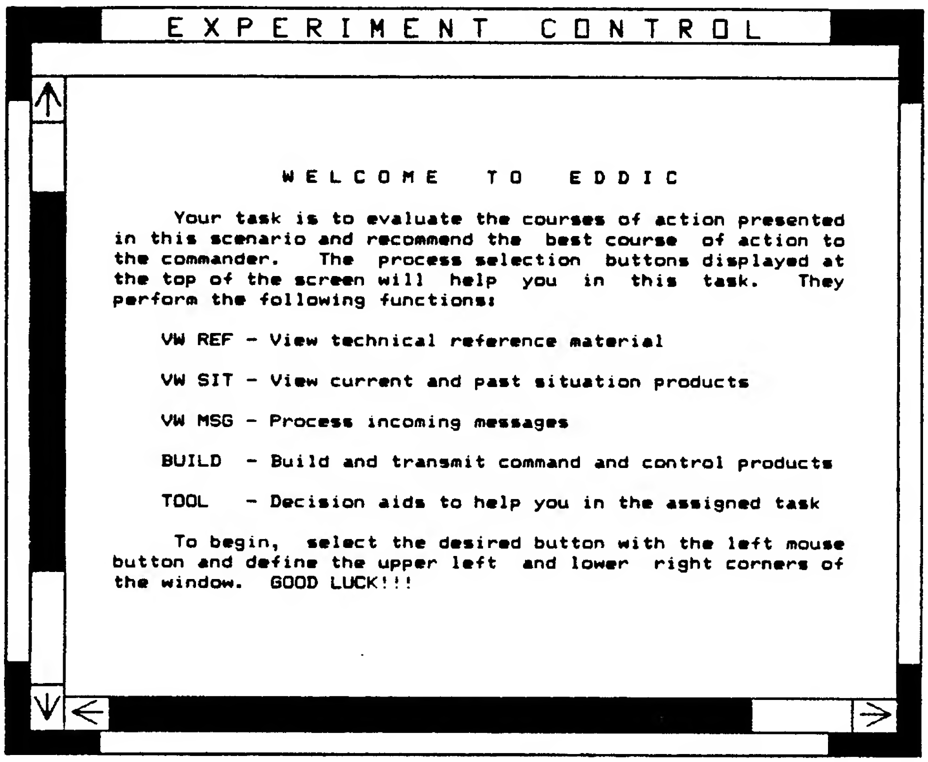


Figure 1.3.3.6-1 EXPERIMENT CONTROL WINDOW

This window is automatically created by the software when an experiment control message is routed to a participant. After the window is displayed, the participant can close the window into a icon, enter data into the displayed form, or terminate the window. If the experiment control message requires participant input, a completed form shall be transmitted to the experiment control process upon termination of the window.

2. EDDIC COMPUTER AND LABORATORY FACILITIES

The EDDIC facility is located in Building 90 at Fort Leavenworth, Kansas. The facility consists of a computer room, experimental laboratory, 2 experiment rooms, and an observation room. The physical layout of the building is shown in Figure 2-1.

The computer equipment consists of scientific workstations with high-resolution color graphics, high-resolution AI workstations and personal computers. Table 2-1 shows the EDDIC hardware and Table 2-2 shows the software available on each computer.

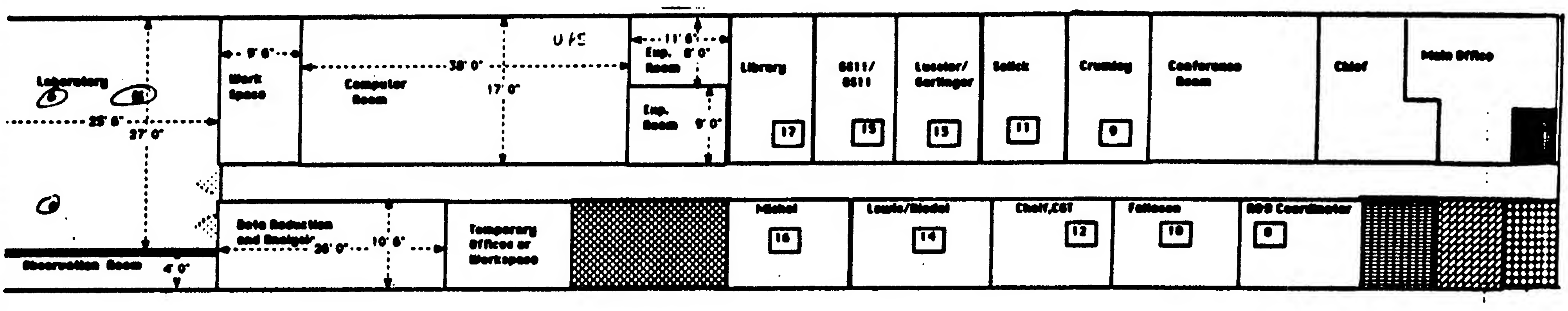


Figure 2-1 EDDIC BUILDING LAYOUT

Hardware Item	Quantity
Sun 3/160C	2
4 MB Memory	
71 MB Disk	
45 MB 1/4" Tape	
Ethernet	
19" Color Monitor	
Sun 3/160C	1
4 MB Memory	
380 MB Disk	
380 MB Disk	
1600 BPI 1/2" Tape	
Ethernet	
19" Color Monitor	
Sun Laser Writer	1
Symbolics 3640	6
4 MB Memory	
300 MB Disk	
45 MB 1/4" Tape	
Ethernet	
19" Color Monitor	
19" Monochrome Monitor	
Symbolics 3675	1
4 MB Memory	
474 MB Disk	
474 MB Disk	
474 MB Disk	
300 MB Removable Disk	
45 MB 1/4" Tape	
Ethernet	
Apple Mcintosh Plus	4
Imagewriter II Printer	
Modem	
Mousepad	
Kensington Control Center	
Zenith Z248	4
512 K Memory	
20 MB Fixed Disk	
360 K Flexible Disk	
COMPAQ Plus	4
512 K Memory	
10 MB Fixed Disk	
360 K Flexible Disk	

Table 2-1. EDDIC HARDWARE

Software Item	Quantity
Sun	
3.0 Sun Operating System	3
SunGKS	3
C	3
FORTRAN 77	3
VERTEX Ada	1
SCLISP	3
X-Windows	1
Symbolics	
7.0 Symbolics Operating System	7
FORTRAN	1
PASCAL	1
Ada	1
TCP/IP	1
Apple Mcintosh	
Picturebase	4
Telescape	4
Factfinder	4
Click-on Worksheet	4
MacBatterypack	4
Statview	2
Videoworks	2
Fullpaint	4
Fontastic	1
Copy II	1
Thinktank	1
MacCopy	1
Chipwits	1
Microsoft Word	1
Zenith Z248	
MS-DOS	4
Microsoft Windows	4
GWBASIC	4
Wordperfect	3
GEM Package	1
Lotus 1-2-3	2
Wordstar	2
PC Draw	1
PC Paintbrush	3
PC Storyboard	1
Thinktank	2
Desq View	1
Dbase III	2

Table 2-2. EDDIC SOFTWARE

APPENDIX A - Data Dictionary for Dataflow Diagrams

Data Element Name: AID_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display output from the aids that will be integrated into the EDDIC system.

Data Element Name: ANALYSIS_INPUT

Aliases:

Values and Meanings:

Notes:
The input by the experimenter or analyzer during the process of analyzing an experiment.

Data Element Name: BUILD_DISPLAY

Aliases:

Values and Meanings:

Notes:
The window display for the building of command and control products. This display can be either textual or graphical.

Data Base Name: C2_PRODUCT

Aliases:

Composition:

```
Organization: NUMBER_OF_PRODUCTS       +
              (FUNCTIONAL_AREA         +
               DATA_CATEGORY           +
               DATA_ELEMENT            +
               DATE_TIME               +
               PRODUCT_TYPE            +
               PRODUCT_CONTENTS)
```

Notes:

Data Element Name: C2_PRODUCT_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window for the viewing of command and control products. This window can be either textual or graphical.

Data Element Name: C2_PRODUCT_REQ

Aliases:

Values and Meanings:

Notes:
A message sent to the C2_PRODUCT_MANAGER requesting a product or a product form. All products that are displayed or built will be accessed with this data element.

Data Element Name: C2_PRODUCTS

Aliases:

Values and Meanings:

Notes:
The products that are returned from the C2_PRODUCT_MANAGER after a reqeust for a product has been sent to it. The products can be textual reports, graphs, or map overlays.

Data Element Name: C2_SITUATION_AID_DATA

Aliases:

Values and Meanings:

Notes:
Data that are returned to the MANAGE_C2_SITUATION_DISPLAY from any aids that are integrated into the process of viewing command and control products.

Data Element Name: C2_SITUATION_DATA

Aliases:

Values and Meanings:

Notes:
Data that are copied from the View Situation window to be inserted into a product or notepad.

Data Element Name: CONTROL_AID_DATA

Aliases:

Values and Meanings:

Notes:
Data that are returned to the MANAGE_CONTROL_DISPLAY process from any aids that are integrated into EDDIC to help the participant work with the experiment control window.

Data Element Name: CONTROL_DATA

Aliases:

Values and Meanings:

Notes:
Data that are copied from the Experiment Control window to be inserted into a product or into the notepad.

Data Element Name: CONTROL_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window for displaying experiment control messages and forms. This window is created on a participants screen by the CONTROL_EXPERIMENT process.

Data Element Name: CONTROL_REQUEST

Aliases:

Values and Meanings:

Notes:
A message sent to the CONTROL_EXPERIMENT process for an experiment control message.

Data Element Name: CONTROL_VARIABLES

Aliases:

Values and Meanings:

Notes:
Any actions taken by the participant or experimenter that must be reported to the CONTROL_EXPERIMENT process for analysis and feedback purposes.

Data Element Name: DEFINITION_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window for defining an experiment. This may include many programs with individual interfaces.

Data Base Name: DIGITAL_MAP

Aliases:

Composition:
(DIGITAL_IMAGE_BUFFER)

Organization:

Notes:

Data Base Name: EXPERIMENT_CONTROL_RULE_DB

Aliases:

Composition:
(EXPERIMENT_RULE)

Organization:

Notes:
Rules that will control the flow of messages and forms to a participant's Experiment Control window.

Data Element Name: EXPERIMENT_CONTROL_MESSAGE

Aliases:

Values and Meanings:

Notes:
A textual message or form that is transmitted from the CONTROL_EXPERIMENT process to a participants Experiment Control window.

Data Flow Name: EXPERIMENT_DB

Aliases:

Composition:

```
EXPERIMENT_CONTROL_RULE_DB          +
EXPERIMENT_LOG                      +
C2_PRODUCT                          +
SITUATION_DB                        +
REFERENCE_DB
```

Notes:

Data Flow Name: EXPERIMENT_DISPLAY

Aliases:

Composition:

```
PRODUCT_DISPLAY                     +
BUILD_DISPLAY                       +
TOOL_DISPLAY
```

Notes:

Data Base Name: EXPERIMENT_LOG

Aliases:

Composition:

```
NUMBER_OF_TRANSACTIONS              +
(TRANSACTION_DATE_TIME              +
 TRANSACTION_TYPE                   +
 TRANSACTION)
```

Organization:

Notes:
Record of the transactions that occurred during an experiment.

This database provides the majority of the data used to analyze the experiment.

Data Element Name: EXPERIMENT_REPORTS

Aliases:

Values and Meanings:

Notes:
The textual and graphical reports that are generated by the experiment analysis process.

Data Element Name: EXPERIMENTER_ACTIONS

Aliases:

Values and Meanings:

Notes:
Actions taken by the experimenter during an experiment that must be recorded for post-experiment analysis.

Data Element Name: EXPERIMENTER_INPUT

Aliases:

Values and Meanings:

Notes:
Inputs made by the experimenter on the experimenter's workstation to control and observe an experiment.

Data Base Name: KNOWLEDGE_BASE

Aliases:

Composition:
To be Determined

Organization:

Notes:

Data Element Name: MESSAGE_AID_DATA

Aliases:

Values and Meanings:

Notes:
Data that are transferred to the MANAGE_MESSAGE_DISPLAY process from any aids that are implemented into EDDIC to aid the user in viewing and processing messages.

Data Element Name: MESSAGE_DATA

Aliases:

Values and Meanings:

Notes:
Data that are copied from the message display for insertion into a product or into a notepad.

Data Element Name: MESSAGE_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window where tactical messages will be displayed and processed.

Data Element Name: OVERLAY_DISPLAY

Aliases:

Values and Meanings:

Notes:
All graphics that are displayed on top of a digital map background.

Data Element Name: PRODUCT_AID_DATA

Aliases:

Values and Meanings:

Notes:
Data that are transferred to the MANGE_BUILD_DISPLAY process from any aids that are implemented into EDDIC to help a participant build and transmit products.

Data Flow Name: PRODUCT_DATA

Aliases:

Composition:

REFERENCE_DATA +
C2_SITUATION_DATA +
CONTROL_DATA +
MESSAGE_DATA

Notes:

Data Element Name: PRODUCT_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window for building command and control products and transferring them to other participants or to the C2 product database.

Data Element Name: REFERENCE_DATA

Aliases:

Values and Meanings:

Notes:
Data that are copied from the view reference display for insertion into a product or into a notepad.

Data Base Name: REFERENCE_DB

Aliases:

Composition:

NUMBER_OF_PRODUCTS +
(FUNCTIONAL_AREA +
DATA_CATEGORY +
DATA_ELEMENT +
PRODUCT_TYPE +
PRODUCT_CONTENTS)

Organization:

Notes:

Data Element Name: REFERENCE_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window for viewing of technical reference products. These products may be textual reports, graphs, or map overlays.

Data Element Name: REFERENCE_PRODUCT

Aliases:

Values and Meanings:

Notes:
The contents of the view technical reference display. Each product is assigned to a functional area, data category and data element and is selected using a walking menu.

Data Element Name: REFERENCE_REQ

Aliases:

Values and Meanings:

Notes:
A message that is sent to the reference database manager to request a reference product for display in the view technical reference window.

Data Element Name: SITUATION_CONTROL_INPUT

Aliases:

Values and Meanings:

Notes:
Changes to the situation data that are caused by the experiment or a simulation that is providing dynamic input to the tactical situation.

Data Element Name: SITUATION_DATA

Aliases:

Values and Meanings:

Notes:
Data that describe the tactical situation. Unit descriptions, control measures and other battlefield data are included in the situation data.

Data Base Name: SITUATION_DB

Aliases:

Composition:
UNIT_DESCRIPTION +
CONTROL_MEASURES

Organization:

Notes:
The situation database contains both current and past tactical situation data.

Data Element Name: SITUATION_REQUEST

Aliases:

Values and Meanings:

Notes:
A message sent to the situation database manager to either retrieve situation data or update the situation database.

Data Element Name: SUBJECT_ACTIONS

Aliases:

Values and Meanings:

Notes:
Inputs made by the participant during an experiment that must be recorded for post-experiment analysis.

Data Element Name: SUBJECT_INPUT

Aliases:

Values and Meanings:

Notes:
Actions taken by a subject to select reports and generate products. These inputs are usually done either with the keyboard or mouse.

Data Element Name: TAILORED_INTERFACE

Aliases:

Values and Meanings:

Notes:
Soldier machine interface that is customized for the subject based on the knowledge the system has about the subject and the task he is performing.

Data Element Name: TOOL_DATA

Aliases:

Values and Meanings:

Notes:
Data that are copied from a tool display to be inserted into a product.

Data Element Name: TOOL_DISPLAY

Aliases:

Values and Meanings:

Notes:
The display window where all off-line tools will be made available to the experiment participants. In the initial design, only a notepad tool will be provided.